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1. Introduction

Most previous archaeological activities at Lumbini have tended to focus attention on the Maya Devi Temple, Shakya Tank, Asokan Pillar and the structures in their immediate vicinity, paying little attention to the potential presence of archaeological remains beyond. Indeed, P.C. Mukherji only exposed and planned monuments adjacent to the pillar, tank and shrine in the 1890s (1901) and the levelling and construction directed by General Kesher Shumsher J.B. Rana in the 1930s was similarly tightly focused. This continued through to the Indian Co-operation Mission led by Debala Mitra, when she partially exposed the Asokan pillar in 1962 (Mitra 1972). This state of affairs has meant that little consideration has been given to the location of ancient *Lumminigame*, the village named on the Emperor Asoka's famous pillar of chunar sandstone. Representing the oldest named village in South Asia, in 249 BCE Asoka had famously reduced its tax on account of its association with the birthplace of the Buddha (Allen 2008: 142; Falk 1998: 16). Despite its historic importance, it was not until 1970 that the first research surveys and excavations were undertaken to locate and date its sequence. These endeavours were directed by N.R. Banerjee and B.K. Rijal and focused on a site referred to as the 'Southern Mound' on top of which General Kesher Shumsher J.B. Rana had built a rest house in the 1930s (Rijal 1977: 30). Unfortunately, Rijal only published a short summary of his findings in a later paper but stressed that he had found evidence of a sequence running from the sixth century BC until the Gupta period (ibid.). With finds of Northern Black Polished Ware (NBPW) in the lowest levels, he also recorded encountering a mud wall and a terracotta ring well of at least 16 courses as well as a Gupta terracotta "plaque mould of Lord Buddha in the Earth Touching posture" (ibid.: 31). Later summarising Rijal's findings, T.N. Mishra confirmed that the site had been occupied between 400 BCE to the eighth century CE and covered an area of 600 metres east to west by 300 metres north to south (Mishra 2004: 13).

When the Japanese architect Kenzo Tange initially developed his Lumbini Master Plan, it is of note that his early reports showed little concern for the Southern Mound. Indeed, the UN Lumbini Brochure of 1970 marked the old Rest House and adjacent Malaria Post on the plan of the site and noted that these modern buildings "could be safely removed to the advantage of the site" (UN 1970: 6). Recommending that the area around the Sacred Garden be planted and landscaped, however, the brochure was clear to state that "it would be essential to make a careful inventory of everything which is presently on the site and conduct a thorough archaeological survey" (ibid.: 16). Following Rijal's exploratory excavation, Kenzo Tange's detailed report and topographical map of the area was updated and the mound was then identified as Zone 2 and designated a site of archaeological interest (1976: Figure 2). Tange's next report considered the mound more fully and stated that "To the south-west of the complex, about 300 metres away from it, is a mound which is believed to be the remains of the village that existed contemporaneously with the religious complex and accommodated facilities for the complex. The complex and the mound is connected by an ancient road" (Tange 1977: 71). Tange further recommended that the archaeological remains were thoroughly excavated to understand the "total picture of ancient urban composition" and for decisions to be made as to which phases to expose and present to visitors and pilgrims (ibid.). As significantly, Tange warned that the construction of roads and the levee might damage archaeological remains and recommended that when such archaeology was encountered "the present layout can be modified without altering the basic system" (ibid.: 71). In parallel, the UN's 1979 brochure was updated and the mound was named the 'Old Lumbini Village', defined on its southern and western edges by the levee surrounding the Sacred Area (UN 1979: 15). As in the earlier brochure, the need to protect the archaeological remains was recognised and it was suggested that walkways could be raised and that there would be no new constructions within the Sacred Area (ibid.: 12). In 1978, Tange reported that the "old Lumbini village is being investigated, but for the present, the top priority has been given to the sites found around the Ashoka Pillar and the Maya-devi Temple" (1978: 7). Therefore, after this date, no additional archaeological activities were undertaken at the site and additional buildings, services and activities affected the site as the Police Station, now resident within the Old Rest House, expanded. In addition to this continued occupation and damage to the subsurface archaeology, and despite Kenzo Tange's own warnings about avoiding damage to archaeological remains, the completion of the digging of the levee destroyed a significant portion of the ancient settlement between 2002 and 2009. Currently, the ancient settlement lies outside the UNESCO World Heritage property and is thus not afforded the same level of recognition or protection. As a result, one of the first activities of the first phase of the UNESCO/JFiT sponsored *Strengthening the Conservation and Management of Lumbini, the Birthplace of Lord Buddha* project was to better characterise and date *Lumminigame*'s archaeological remains.

2. Topography

The Southern or Village Mound represents a distinct raised area some 200 metres south-west of the Asokan Pillar and Maya Devi Temple complex (Figure 1). The western part of this three metre high area of ground is covered by the Rana Period rest house built by General Kesher Shumsher J.B. Rana in the 1930s which, although recommended for removal by the Kenzo Tange Master Plan, is still in use today as a police station. Originally unfenced, unrest between 1996 and 2006 led to the construction of barbed wire fences and a large defensive earthen rampart around the entire mound, complete with block houses. This construction involved the introduction of soil from outside the site onto the mound, potentially contaminating the in situ archaeological deposits. As also noted above, the southern edges of the mound were also destroyed during the digging of the Master Plan's central levee and, as a result, an international team of archaeologists carried out geophysical survey, auger coring, excavations and geoarchaeological investigations in order to better understand both the extent and chronological sequence of the ancient site. Our investigations focused on two areas of the Village Mound, the portions of the mound exposed and damaged in the banks of the new levee and the parade ground to the south of the Police Station (Figure 2). Whilst an earlier auger-core transect across the Sacred Garden had already identified a clear cluster of cultural material in the vicinity of the mound in 2001 (Coningham *et al.* 2011), two additional transects were taken across the Village Mound in 2011 in order to confirm its profile and depth of cultural material. These profiles were laid east to west and north to south across the mound and demonstrate a greater depth of cultural material in and around the compound. In total, five major episodes were identified within the auger profile: two cultural deposits, Layers A and B; one modern layer, Layer C; and two natural deposits, Layers D and E. As a result, we were able to confirm that in places across the Village Mound there were at least 3.5 metres of human occupation (Figure 3). As significantly, we also confirmed that the settlement had been established on a natural mound, presumably to lift the habitation above the surrounding flood plain.

3. The Levee Bank

This area, east of the Police Station, was first surveyed in 2001 utilising both earth resistance and fluxgate gradiometer, in addition to being sampled by auger core transect (Coningham et al. 2011). The auger core survey, which consisted of two transects crossing the Sacred Garden at the Asokan Pillar and running north to south and east to west, revealed a clear concentration of buried cultural material in the area of the Village Mound on the southern end of the north to south transect, one of just three such concentrations within the immediate environs of the Sacred Garden (ibid.: 12). This preliminary identification of a significant concentration of cultural material was strengthened during initial observations in the 2011 field season, when significant quantities of ceramic sherds were seen eroding out of the east-facing bank of the recently cut levee. This cut, part of the landscaping associated with the Master Plan, had truncated and destroyed several cultural deposits, exposing dense concentrations of ceramics in the process. Meanwhile, the 2001 geophysical survey of this area had revealed a grouping of four distinct curvilinear magnetic anomalies, which were interpreted as forming semi-circular enclosures associated with ephemeral structures (ibid.: 13-14) (Figure 4). In order to better evaluate and interpret this potential settlement that the geophysics, auger coring, and levee bank suggested lay within this area, we opened two trenches, A and B in 2011. Trench A was a small sondage, measuring 1.5 x 2.5 metres, cut into the levee bank in order to gain a better understanding of the cultural and depositional sequence of the mound while Trench B started as a larger 12 x 1 metre slot that targeted the group of curvilinear geophysical anomalies in order to investigate these possible structures.

3.1 Trench A: Levee Sondage

Trench A was located on the east-facing bank of the recently cut levee bank in the vicinity of dense concentrations of ceramic sherds eroding out of the bank and measured 1.5 metres north to south and 1m east to west at surface level, although the length of the sondage increased as excavations went on due to the angle of the levee bank, reaching 2.5 metres (east to west) at the base of the sondage (Figure 5). The in situ natural of Trench A was a vibrant yellow clay, which bore close resemblance to the natural identified in the 2001 auger cores across the Village Mound. Overlying this natural, we identified a largely sterile transitional deposit of greyish-yellow silty-clay, measuring 0.2 metres in thickness, which was interpreted as a palaeosurface representing some of the earliest human activity within this area. An Optically Stimulated Luminescence (OSL) sample from this palaeosurface produced an age estimate of 1280 ±200 BCE. This second millennium BCE land-surface was cut by a large sub circular pit (Figure 6), which was nearly 0.5 metres deep and cut through into the natural clay below. This pit measured just over one metre wide (north to south) and over 1.40 metre in length (east to west) - running into the trench sections to the west, and truncated by the levee cut to the east. The pit was filled by a dark greyish brown silty clay that was extremely rich in cultural material. Close to a thousand ceramic sherds were recovered from this pit fill and it appeared that several complete vessels were broken in situ on the base of the pit, including one large Red Ware (RW) vessel in 46 sherds that almost lined the base of the pit. While the great majority of the ceramics recovered from pit fill were undiagnostic RW and Black Slipped Ware (BSW) sherds, a number of sherds of Proto Northern Black Polished Ware (Proto-NBP) were also recovered, as well as a single sherd of Painted Grey Ware (PGW). In addition to the heavy concentration of ceramics, the fill also contained frequent charcoal inclusions, often large in size, along with a fully articulated hoof (tentatively identified as cattle). An OSL sample from this pit-fill produced an age estimate of 670 ±160 BCE, however, a radiocarbon date from a bone fragment within this pit-fill produced a calibrated age estimate (at 68.2% confidence) of 125-215 CE. There is a clear disagreement between these two dates and one possibility is that the pit-fill was insufficiently bleached during deposition.

Above, and sealing both the pit fill and its surrounding palaeosurface, was a greyish brown silt measuring some 0.30 metres in thickness. This layer contained a large volume of ceramics, including two decorated body sherds, a few sherds of BSW, one sherd of Fine Grey Ware, one small body-sherd of Proto-NBP, and one decorated rim-sherd of a small collared vessel. An OSL sample from this cultural silt produced an age estimate of 255 ±170 CE, which may suggest a significant hiatus between deposition of this cultural silt and the filling of the pit below, if we accept the OSL date for the pit fill. However, if we instead accept the radiocarbon date of 125-215 CE from the pit-fill, then the chronological sequence is far more constrained. Overlying this greyish silt was a 0.30 metre thick, culturally rich deposit that was similar in nature to the greyish brown silt below, but far richer in cultural material, containing over a thousand ceramic sherds – the vast majority of which were RW, although a handful of sherds of BSW were recovered too. An OSL sample from this cultural silt produced an age estimate of 635 ±105 CE, placing it well within the first millennium CE. Finally, sealing these cultural layers were shallow topsoil and subsoil layers comprised of mixed deposits of greyish brown silt, measuring just 0.1 metre to 0.2 metre in thickness respectively.

3.2 Trench B: Geophysical Anomalies

Trench B measured 12 by 1 metre (north to south) and was located over the densest cluster of geophysical anomalies identified by the 2001 survey (Coningham *et al.* 2011) in the hope of identifying the features associated with the two curvilinear and one linear anomalies (*ibid.*) (Figure 4). We began by clearing a 25 x 50 metre (oriented north to south) area of vegetation to allow a walkover survey and surface collection. However, despite exposing the topsoil, no visible artefacts or cultural material were exposed – in striking contrast to the levee banks. Excavation began by removing a shallow 0.1 metre thick topsoil from the length of the trench, producing a significant quantity of heavily abraded ceramic sherds, along with two modern iron nails, a small fragment of copper ore, five fragments of ferrous slag, a terracotta spout, and a plastic bottle lid. Removal of the topsoil exposed a 0.2 metre thick greyish brown sandy-silt subsoil across the length of the trench. This subsoil was extremely similar in appearance and consistency to the topsoil above. However, unlike the topsoil, the subsoil was free of modern artefacts, contained fragments of brickbat, and the ceramic sherds were both larger in size and less abraded. In addition to the significant quantity of undiagnostic ceramics (over seventeen thousand sherds were recovered), a small number of sherds of Cord Impressed Ware (CIW) and BSW were recovered, as well as a number of special finds, including two ceramic discs, an iron arrow head, five fragments of glass bangles, a fragment of terracotta mould, two fragments of terracotta figurine legs, five terracotta spouts, a large quantity of slag (30 fragments/0.5 kilograms), and a large number of decorated ceramic sherds including Cord Impressed Ware, one stamped ceramic sherd with a sun or flower design, and a sherd of RW with an incised Swastika graffito. At this point, due to time constraints and the excessive quantities of non-diagnostic ceramics produced by the removal of topsoil, Trench B was subdivided into three smaller sondages - B1, B2 and B3 (Figure 7).

3.3 Trench B1

Trench B1 measured 1.5 x one metres and was located at the centre of the 12 metre long trench, deliberately located to avoid any of the geophysical anomalies with the intention of reaching natural. Trench B1 successfully uncovered two early structural phases, the earliest represented by two postholes and one stakehole, and the later by a series of bell-shaped pits cut into natural and redeposited clay (Figure 8). This earliest sequence of occupation is represented by a shallow 0.25 metre deep pit, two postholes and a stakehole cut into the natural yellow clay at the base of the sequence. These features represent the earliest phase of human settlement activity in the Trench, although they are partially truncated by the cutting of a later large bell-shaped pit in the second structural phase. The two postholes, both located in the south-east corner of Trench B1, were both shallow and measured only around 0.1 metre deep and 0.2 metres in diameter. The stakehole, also located in the south-east corner, was also around 0.1 metre deep but only 0.05 metre in diameter. Due to their location against the section, it is difficult to interpret the function of these postholes. The pit, postholes and stakehole were filled by a culturally modified natural that was devoid of artefacts. The second phase is comprised of two bell-shaped pits into the natural yellow clay and the 0.3 metre thick redeposited natural that lay above. These pits run into the west, south and east-facing sections of trench B1. This redeposited natural consisted of a compacted light grey silty clay with charcoal flecking and small ceramic inclusions. It is possible that a wattle and daub wall or superstructure may have sat above these pits as fragments of daub were recovered from the tertiary fill of the southern pit. Due to the partial exposure of the northern pit within the trench, it was not excavated. The southern pit measured around one metre deep and contained three fills. The primary fill was a 0.3 metre thick levelling deposit of firm olive grey silty clay, containing a few hundred sherds of RW along with one sherd of Proto-NBP and one sherd of CIW. This primary fill lay below a 0.3 metre thick secondary fill of culturally modified natural that contained further ceramic sherds (again predominantly RW with a few sherds of BSW) and fragments of bone, although in a smaller quantity and sherd size than in the deposits above. Sealing this was a 0.35 metre thick tertiary fill of soft dark greyish brown silt, that not only contained a very large number of ceramic sherds but interestingly contained a large number of extremely large sherds of ceramic vessels, including one complete v-shaped open bowl in four sherds, a complete rim of a large storage vessel, two large mica flecked RW sherds with spouts and two other near complete bowls. The size, condition and distribution of these broken vessels strongly suggests that many of these vessels were broken in situ. In addition to these large ceramics sherds and broken vessels, several fragments of bone, a fragment of slag, two further terracotta spouts and fragments of daub (sun-dried clay with cereal impressions) were recovered from the primary fill. A charcoal sample from this tertiary fill was produced a radiocarbon age estimate of 660-830 CE (at 93.1% confidence).

Sealing this episode was a thin layer of greyish brown compacted silty clay representing a deliberate levelling of this early structural phase, sealing and levelling as it does the rich cultural fills of these pits. This layer was only around 0.05 metres thick but was rich in ceramic sherds (almost entirely RW), charcoal inclusions and brickbat. Indeed, from a limited area (around 1.0 by 1.5 by 0.05 metres) a terracotta spout and 422 ceramic sherds were recovered. A charcoal sample from this levelling episode produced a radiocarbon date of 760-890 CE (at 69.9% confidence). Cut into this floor surface was a shallow gully – possibly a wall slot, measuring approximately 0.20 metre long, just 0.03 metre wide and between 0.02 and 0.05 metre in depth, and oriented southwest-northeast. Above this was a 0.25 metre thick dark greyish brown cultural silt that yielded a number of sherds of BSW (in addition to the ubiquitous RW) as well as a terracotta disc and two fragments of bone. Overlying this was a further brick structural phase, represented by a partially collapsed brick wall, extant to a maximum of four courses, and constructed from fired orange clay bricks with no visible surviving mortar (Figure 9). The "wall" appears to have run from north-northwest to south-southeast and had slumped westwards, distorting the orientation and form of the wall's original form. One sherd of NBP was recovered from within the brick wall collapse. This was sealed by culturally rich, greyish brown silty clay, which produced a large quantity of ceramics, including sherds of BSW, CIW, and one sherd of Proto-NBP as well as nearly 6,000 sherds of undiagnostic RW.

Additionally, we recovered a fragment of coloured glass bangle with a rope pattern, six terracotta spouts, two fragments of worked stone, two fragments of vitrified brick, and two fragments of animal bone. The final layer of Trench B1, lying below the subsoil that covered the length of Trench B, was a 0.25 metre thick dark greyish brown cultural silty clay. From this mixed cultural deposit twenty fragments of animal bone were recovered, in addition to six terracotta spouts, a terracotta spiral cone or gaming piece, a small terracotta ball, four fragments of glass bangles and a clear drilled glass bead. It is also interesting that a significant quantity of metal-working residues were recovered from this deposit, with over 60 fragments of ferrous slag, weighing nearly 2.5 kilograms, which may have contributed to the geophysical survey results. This layer, like the topsoil and subsoil above, was incredibly rich in ceramics, producing almost ten-thousand undiagnostic sherds – in addition to sherds of BSW, CIW and a single sherd of Proto-NBP.

3.4 Trench B2

Trench B2 was situated at the southern end of Trench B and measured 3 metres in length. Natural was not reached within this trench and excavation within B2 ended above the level that saw the bell-shaped pits within B1. Instead, the earliest structural phase in B2 was a brick structural phase which corresponds to the collapsed wall in B1. In B2, this phase consisted of a shallow spread of bricks that showed clear evidence of deliberate placement in sections, with never more than two courses extant. However, it was unclear whether this represented an area of brick paving or the lower foundations of a brick wall surrounded by areas of brick collapse. Further future excavation of this area would enable a better understanding of the form and function of this structural episode. This structural phase was sealed by culturally rich dark greyish brown silty clay, similar to that which sealed the wall collapse in B1. However, three features were identified cut into the upper surface of this material in Trench B2, a shallow possible wall slot and two shallow but regularly shaped stakeholes in direct alignment with the wall slot. The possible wall slot was filled by a light yellowish brown sandy silt and varied in depth and appeared to end upon or at a large brickbat. The stakeholes were both regular and circular in shape but with just two stakeholes the form or function of this feature is unclear. This final ephemeral structural phase was sealed by a 0.25 metre thick dark greyish brown cultural silty clay, identical to that seen in B1.

3.5 Trench B3

Very little was identified in B3, despite reaching a comparable depth to B2. No structural features of phases were identified within B3 and, instead, we exposed a series of three thick mixed cultural silts that produced a sherd of Cord Impressed Ware (CIW), two fragments of animal bone, and three terracotta spouts. Each of these silts appears to correspond to sealing episodes in B1 and B2 – but B3 lacked either the brick structural phase seen in B1 and B2, or the ephemeral late phase represented by the wall-slot and stakeholes in B2.

4. The Police Station

Although the 2011 excavations around the eastern levee bank area of the Village Mound identified a number of structural phases, due to the limited area excavated we were unable to map or describe the form of these early structural phases. Consequently, our 2012 investigations focused on the central part of the mound covered by the Rana Period structure which currently hosts the Police Station. During the 2011 auger-coring profile, we revealed a cultural sequence that exceeded three metres in depth in one area, the deepest cultural sequence identified anywhere during the auger-survey of Lumbini. Furthermore, geophysical survey in 2001 had identified a series of potential structures (Coningham *et al*. 2011). In order to investigate this extensive cultural sequence and identify the structural forms of early occupation and evaluate the risk posed to the archaeology by the ongoing use of the Police Station, we excavated a single two by two metre trench on the Police Station parade ground – designated Trench P (Figure 10). The earliest phase of human occupation or activity in this area was represented by three shallow pits cut into the natural yellow clay around 2.5 metres below the surface. Although all three pits were heavily disturbed through bioturbation or water activity, two of these pits were clearly bell-shaped of approximately 0.4 metres depth, while the third was concave in profile and only 0.2 metres deep. All three pits were filled by washed material, consisting of redeposited natural with cultural inclusions (charcoal flecking and occasional ceramic sherds), and two lenses of fine well-sorted sand suggesting rapidly moving water washing material into these pits – similar to that seen in an episode of flooding. The ceramic assemblage from these pit fills is directly comparable to the earliest levels at the nearby site of Gotihawa with 36% CIW, 30% RW, 16% BSW, 6% Proto-NBPW, and 2% Coarse Ware. All of these ceramics would suggest a date of late second millennium to early first millennium BCE, however, a single OSL sample from one of the pit-fills produced a date-estimate of 3620 ±310 BCE.

Sealing this earliest phase was a 0.5 metre thick episode of mound building in which a compact redeposited natural was built up, likely raising the area above the flood waters that had washed over the earlier pits. This material consisted of a mottled yellow clay with frequent cultural inclusions including ceramics sherds and charcoal flecking, as well as occasional kankar and manganese flecking. An OSL sample from the redeposited natural produced a date estimate of 1310 ±240 BCE. This built up mound was sealed by a 0.1 metre thick surface consisting of a light yellowish brown silty clay that was rich in sherds of BSW, CIW and Proto-NBP. Interestingly, the only identifiable form (some BSW and some Proto-NBP) was that of the thali. A number of these sherds displayed crisp edges with very good surface definition, suggesting that the sherds were deposited rapidly, rather than on an exposed surface for any period of time. This surface was subsequently cut by a shallow posthole and a 0.7 metre deep bell-shaped pit, which cut through the surface and mound, and into the natural below. This pit, located in the south-east corner of the trench had an estimated diameter of between 1.6 and two metres with concave vertical sides. The primary fill was 0.2 metre thick soft grey silt that was interpreted as a deliberate, and possibly ritual, deposit. This distinctive loose grey silt of the fill was very rich in charcoal and ash, along with several fragments of burnt animal bone and ceramics which, like the mound building below, were dominated by CIW, Proto-NBP and BSW wares, while the only forms identifiable were thali. Additionally, three near-intact small globular ceramic vessels were recovered. It is worth noting that Verardi identified identical vessels during his excavations at Gotihawa (Verardi 2007). The secondary fill of this pit appears to represent melt or wash-in from later structural platform as it was rich in small compacted flecks of fired clay. This suggests that the pit remained open for some time. Again, the secondary fill was dominated by CIW, Proto-NBP and BSW wares in addition to a single sherd of NBPW and a small number of undiagnostic RW sherds. There was then what appeared to be a thin clay lining around the top of pit. Immediately north-west of the pit, we found a circular posthole cut into the mound surface, measuring 0.15 metres in depth.

Above the mound's surface, and to the west of the pit, we identified a 0.2 metre thick structural foundation consisting of a sub-rectangular platform of highly compacted silty-clay with occasional fine inclusions of fired clay. Running broadly north to south, this deposit formed a clay core for a compacted deposit which was again rich in crisp sherds of BSW, CIW and Proto-NBP, as well as a number of sherds of undiagnostic red ware and a single sherd of NBPW. An OSL sample from this core material produced a date estimate of 930 +160 BCE, a date that corresponds well with the ceramic assemblage. This deposit was also cut by two stakeholes, suggesting that at some point it was the outer surface of a structural platform itself. This was then sealed by an outer skin of an extremely compacted brown silty clay with a very high concentration of fine fired angular clay fragments. This formed a structural platform produced by ramming a mixed clay, silt and fired clay deposit. This platform ran into the sections of the trench on three sides (west, north and south) but sloped sharply at approximately 135 on its eastern flank, while the upper surface of the structural platform was level and smooth. This surface was then cut by a posthole and a stakehole along its eastern flank, likely forming part of an organic eastern wall – likely wattle and daub. An OSL sample from the external skin of the platform produced an age estimate of 460 +130 BCE. This date, contrasted to the early first millennium BCE date from the platform layer below, suggests a significant period (at least two centuries) between these two deposits – suggesting in turn that this platform had multiple phases of use, and that the outer skin in fact represents a repair or modification to an earlier structure. Once again, the ceramics from this deposit were dominated by BSW and Proto-NBP, with a significant quantity of CIW sherds, a handful of RW sherds and a further single sherd of NBPW.

Following this second structural phase, a dark greyish brown silty deposit built up against the eastern flank of structural platform. It appears certain that this deposit was external to the structure, though it is uncertain whether its deposition is contemporary with, or post-dates, the occupation of the structure. This material was approximately 0.3 metres thick and was rich in ceramic sherds, including a large intact water vessel which was positioned upright with the mouth of the vessel proud above the surface (Figure 11). This vessel was clearly intact when deposited and only fragmented after its burial as evidenced by the existence of several partial fractures. Along with this single vessel were a number of ceramics sherds, again dominated by sherds of BSW, along with a smaller number of CIW and Proto-NBP sherds. As can be seen in the south-facing section (Figure 12), cut into the surface of this material in the north-east corner of the trench was a shallow sub-circular fire pit initially filled by a vibrant red heat affected clay lining, below a charcoal and ash rich secondary fill. This fire pit, and associated structural platform, were all sealed by 0.2 metre thick greyish brown cultural silt that extended across the trench and likely represent structural melt of a wattle-and-daub superstructure. This collapse deposit was in turn cut by shallow bell-shaped pit in the south-west corner of the trench, which was filled in turn by a soft dark grey silt. Both this structural 'melt' and pit fill, again contained sherds of CIW, BSW and Proto-NBP, along with a handful of sherds of RW. Following this initial phase of collapse and abandonment, we identified 0.6 metre thick mixed cultural silt which was rich in brickbat, charcoal, and ceramics – but devoid of any structural features. Once again, this deposit contained sherds of BSW, CIW and Proto-NBP, along with a handful of sherds of RW. Finally, the archaeological sequence was completed by a 0.20 metre thick loose grey mixed cultural silt – again this deposit was rich in charcoal, along with a handful of ceramic sherds (BSW and Proto-NBP) and brickbat. However, it is important to note that this deposit was also disturbed by a plastic water-pipe running through the north-eastern corner of the trench. This pipe, although not large, both cut through in situ archaeological material and was leaking heavily, thus changing the taphonomic conditions of the archaeological deposits. Above this subsoil, the sequence was sealed by a shallow modern subsoil, containing modern detritus such as battery cores, broken glass and plastic and a turf topsoil.

5. Conclusion

Our investigations at the Village Mound have demonstrated the presence of a substantial depth of archaeological habitation at the site. This occupation stretches back at least as far the second millennium BCE, with one of the shallow pit fills at the base of the Trench P sequence producing a radiocarbon date of 1413-1261 BCE (95.4% confidence). These shallow pits were cut into an in situ natural dating to around the same period, with the surface of the natural at the Police Station dating to 1260 +190 BCE, while at the nearby Levee Bank Trench A, the palaeosurface immediately above the natural dated to 1280 +200 BCE. At this time, it appears likely that the fourth millennium BCE date from one of the Police Station shallow pit fills is a result of insufficient bleaching rather than evidence of very early occupation. This initial occupation appears to have ended around the time of an episode of flooding, with a coarse grained sand bearing testimony to fast moving water washing over these early pits and this was immediately followed by a deliberate raising of the area through mound building. The Village 'Mound' is thus an amalgamation of a natural clay rise followed by the deliberate deposition of sediments to further increase the 'mound' and, finally, culturally accumulated sediments comprised of building remains, debris and occupation surfaces. The first phase of occupation on this artificial mound was characterised by the digging of large bell-shaped pits and these were identified in all the Village Mound trenches, both the Police Station and the Levee Bank. These pits appear to date to the first half of the first millennium BCE and were almost certainly not structural, although their precise function(s) remains unclear at this point. All were rich in cultural material, including large quantities of charcoal, ash and ceramics. Similar pits have been identified at Gotihawa, dating to the first phase of occupation at the site between the twelfth and ninth to eighth centuries BCE (Verardi 2007: 69), contemporary with the pits identified at the Village Mound of Lumbini. Furthermore, many of the pits from Gotihawa, like those at the Lumbini Village Mound, contain animal bone, charcoal and ceramics, with exceptionally similar assemblages of ceramics, with the early phase of occupation at both sites characterised by a CIW and BSW – in addition to the ubiquitous Red Wares.

In terms of function, Verardi suggested that the pits at Gotihawa probably related to the uprooting of trees (Verardi 2007: 69), however, the clearly defined edges, sides and bases of the pits at the Lumbini Village Mound and similar assemblages between both sites suggests that they were a more intentional human intervention during the late Chalcolithic period of the Terai. Such pits are not a unique phenomenon and have also been documented throughout the northern belt of South Asia, particularly across the Kashmir and Swat Valleys where, from the fourth millennium BCE, settlements were characterised by the presence of bell-shaped pits at sites such as Burzahom, Gufkral, Kalako-deray and Loebanr III (Coningham and Young 2015: 119-127). Again, the functions of these pits are widely debated and while it has been suggested that the pits may represent underground dwellings by some scholars, providing shelter during cold winters (Stacul 1987, Sharif and Thapar 1992), other interpretations suggest that such pits may actually represent subsurface grain storage pits (Coningham and Sutherland 1998). However, at Gotihawa and the Village Mound, further analysis is required to ascertain the function of the pits, whether ritual, domestic or both. Furthermore, due to the presence of these pits in the northern valleys of Pakistan and India, as well as the Terai, it is also suggested that such pits may have also been a feature of prehistoric communities of the Kathmandu Valley and lower mountain regions, but further archaeological investigation and survey is required to assert such hypotheses.

At Lumbini, further similarities with Gotihawa include the presence of Proto-Northern Black Polished Ware at the Village Mound. Proto-NBP is a particularly interesting ware, as it was first recognised by Verardi at Gotihawa (2007: 248) and is thought to mark the transitional phase from Black Slipped Ware to Northern Black Polished Ware and can be identified through the lustrous black surface with red spots (ibid.). Other characteristics include a black section, a thin slip, fairly thick walls, and the thali form – which represents the most common forms identified at the Village Mound. The highly polished appearance is achieved by firing at very high temperatures and the unique red spots are evidence of a problem in the firing process (ibid.). Verardi's Proto-Northern Black Polished Ware periodisation is between the twelfth and eighth centuries CE with a lingering presence through the Mauryan period but disappearing altogether in Sunga and Kushan periods. The Proto-NBP found at Lumbini is therefore also used as a pre-Mauryan indicator. At Lumbini, this phase is followed by two episodes of domestic structures, consisting of rammed-earth platforms with organic superstructures, dating to the latter half of the first millennium BCE. These structures, which appear to date broadly to around the Mauryan period, arguably represent the Lumminigame that was present during the Emperor Asoka's visit to the site in the third century BCE. Finally, we see scattered brick structures across this area in the early mediaeval period although these were only clipped during the excavations at the Levee Bank.

Our archaeological investigations have demonstrated the substantial nature and deep chronology of the archaeological remains to the south of Lumbini's Sacred Garden with settlement and activity dating back to at least the second millennium BCE, continuing through into the Early Mediaeval period. We have also demonstrated that the occupants at the site were involved in manufacturing, on account of the presence of metal-working smithing slag as well as involved in the slaughter of animals, on account of the presence of numerous fragments of animal bones with cut marks. These activities are notably absent from within the monastic and shrine complexes of the Sacred Garden to the north-east. In this way, it is apparent that ancient Lumbini was subdivided into shrine, monastic and secular zones in parallel with the modern Master Plan of Lumbini with the Tange's New Lumbini Village perhaps playing a similar role to the ancient village. Clearly there is still a great deal to be learned about the ancient Lumminigame, in terms of activities that took place here, the overall size of the settlement, and the relationship between the ancient village and the ancient monasteries, shrines and temples of Lumbini. However, without proper protection and management, this important site is at very real risk from the harmful activities associated with the modern Police Station. Our UNESCO mission report recommended that the Police

Station is relocated elsewhere but this is still to be formally approved by the Government of Nepal. Furthermore, we strongly recommend that the boundary of the World Heritage Site is expanded to ensure the protection of not just the sacred core of Lumbini but its secular character as well.

6. Acknowledgments

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8. Figure

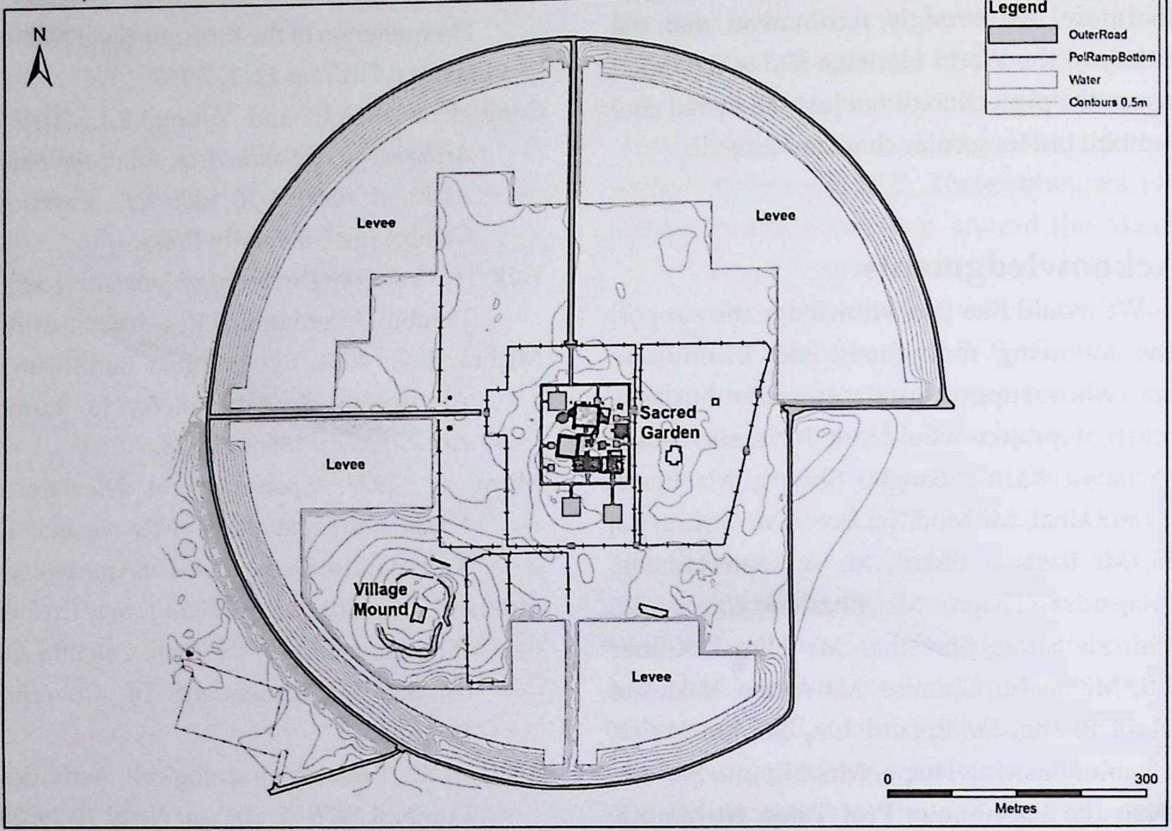
N
Legend
OuterRoad
PolRampBottom
Water
Contours 0.5m
Levee
Levee
Levee
Levee
Sacred Garden
Village Mound
0
300
Metres

Figure 1: Topographic Map of Lumbini showing Sacred Garden and Village Mound

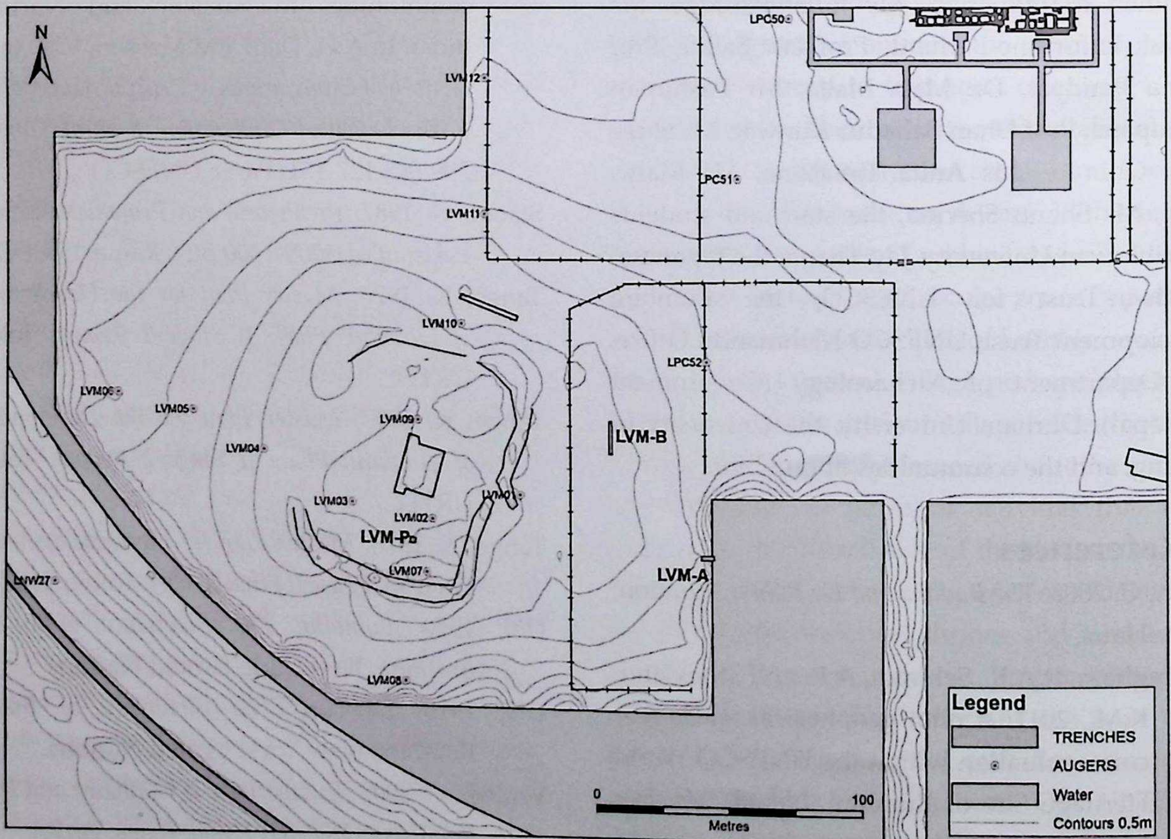
N
LVM12
LVM11
LVM10
LVM06
LVM05
LVM04
LVM09
LVM03
LVM02
LVM01
LVM-P
LVM07
LVW27
LVM08
LPC50
LPC51
LPC52
LVM-B
LVM-A
Legend
TRENCHES
AUGERS
Water
Contours 0.5m
0
100
Metres

Figure 2: Lumbini Village Mound showing areas of investigation

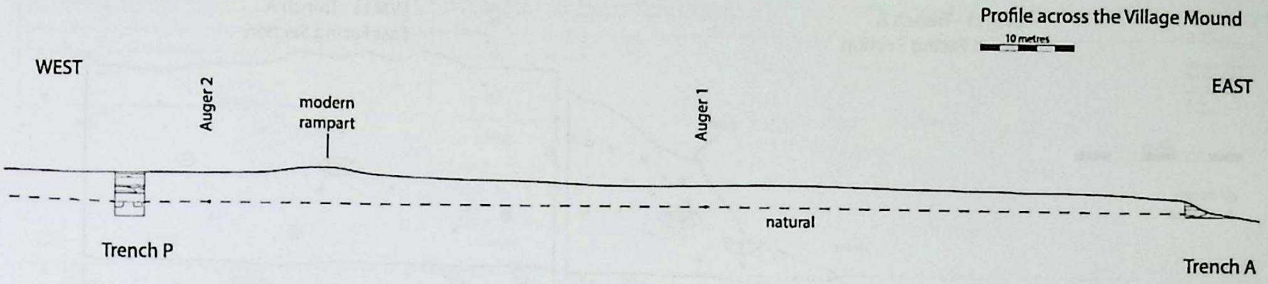
Profile across the Village Mound
10 metres
WEST
Auger 2
modern rampart
Auger 1
EAST
natural
Trench P
Trench A

Figure 3: Profile across the Village Mound, including trenches A and P

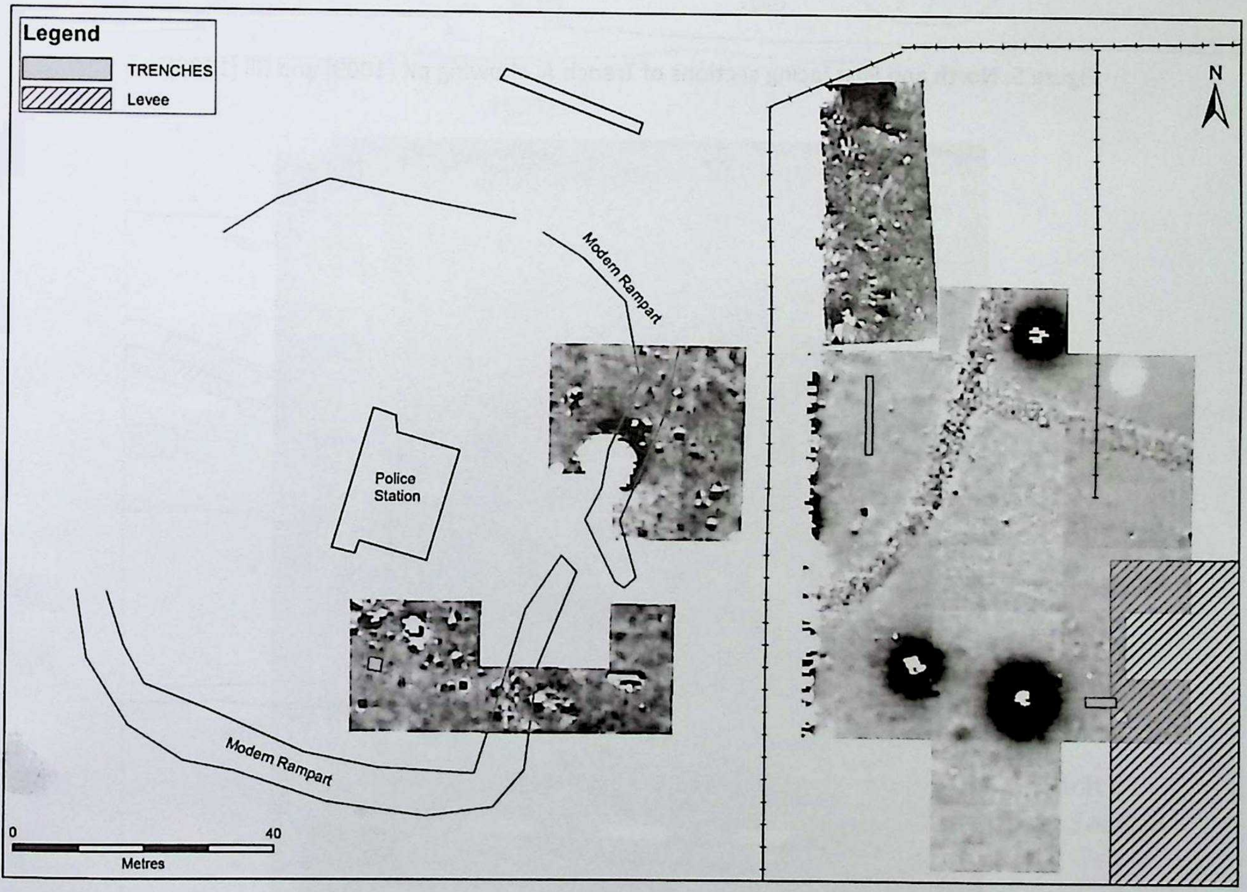
Legend
TRENCHES
Levee
N
Modern Rampart
Police Station
Modern Rampart
0
40
Metres

Figure 4: Geophysical survey results at Lumbini Village Mound

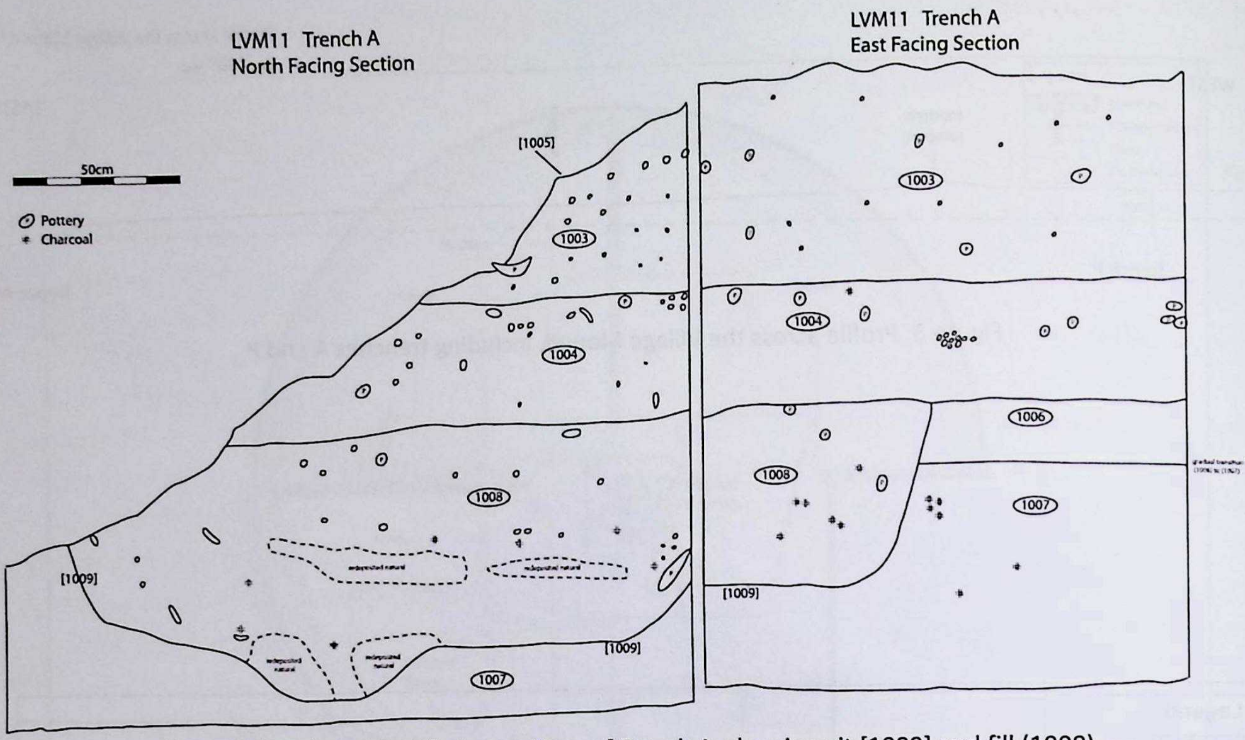
LVM11 Trench A
North Facing Section
LVM11 Trench A
East Facing Section
50cm
Pottery
Charcoal
[1005]
1003
1004
1008
1007
1006
[1009]
redeposited natural
redeposited natural
redeposited natural
redeposited natural
[1009]
[1009]
gradual transition from (1006) to (1007)

Figure 5: North and East facing sections of Trench A, showing pit [1009] and fill (1008).

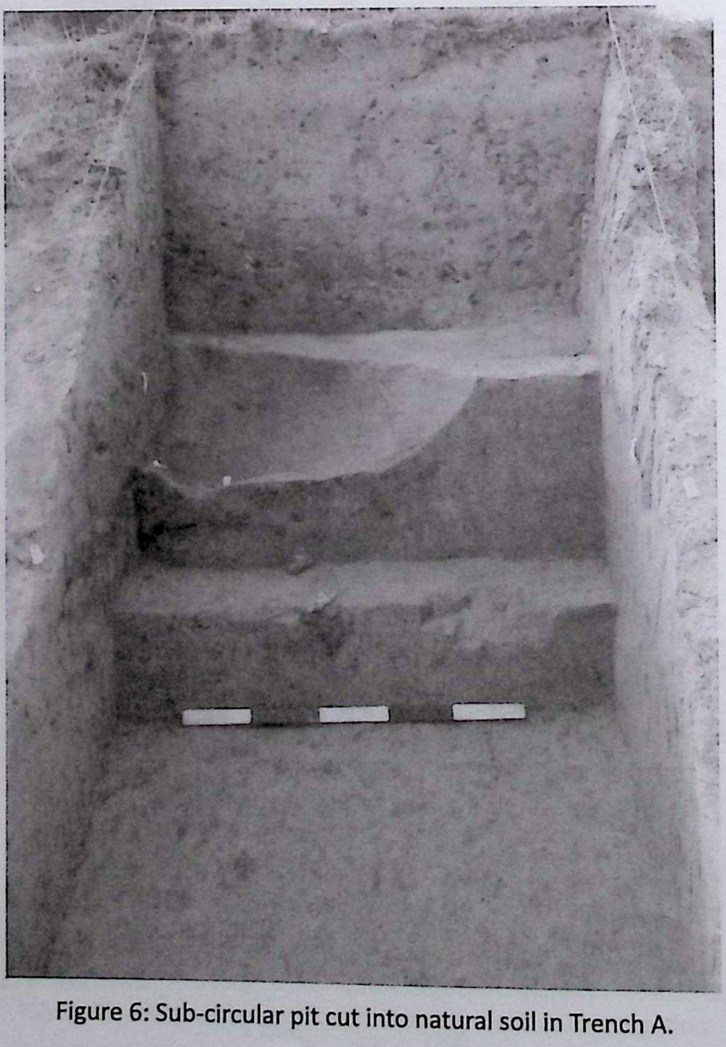

Figure 6: Sub-circular pit cut into natural soil in Trench A.

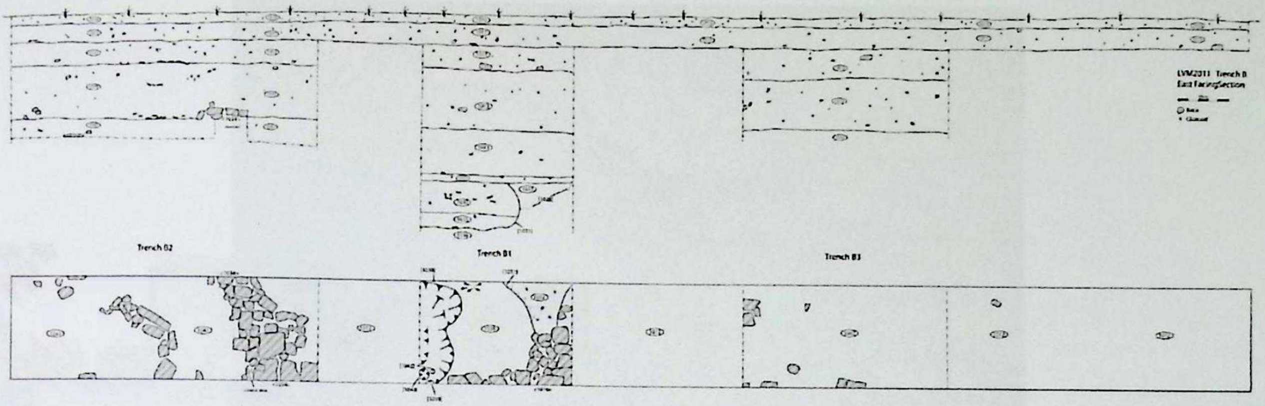
LVM2011 Trench B
East Facing Section
Trench B2
Trench B1
Trench B3

Figure 7: Plan and East Facing Section of Trench B (B1, B2 and B3).

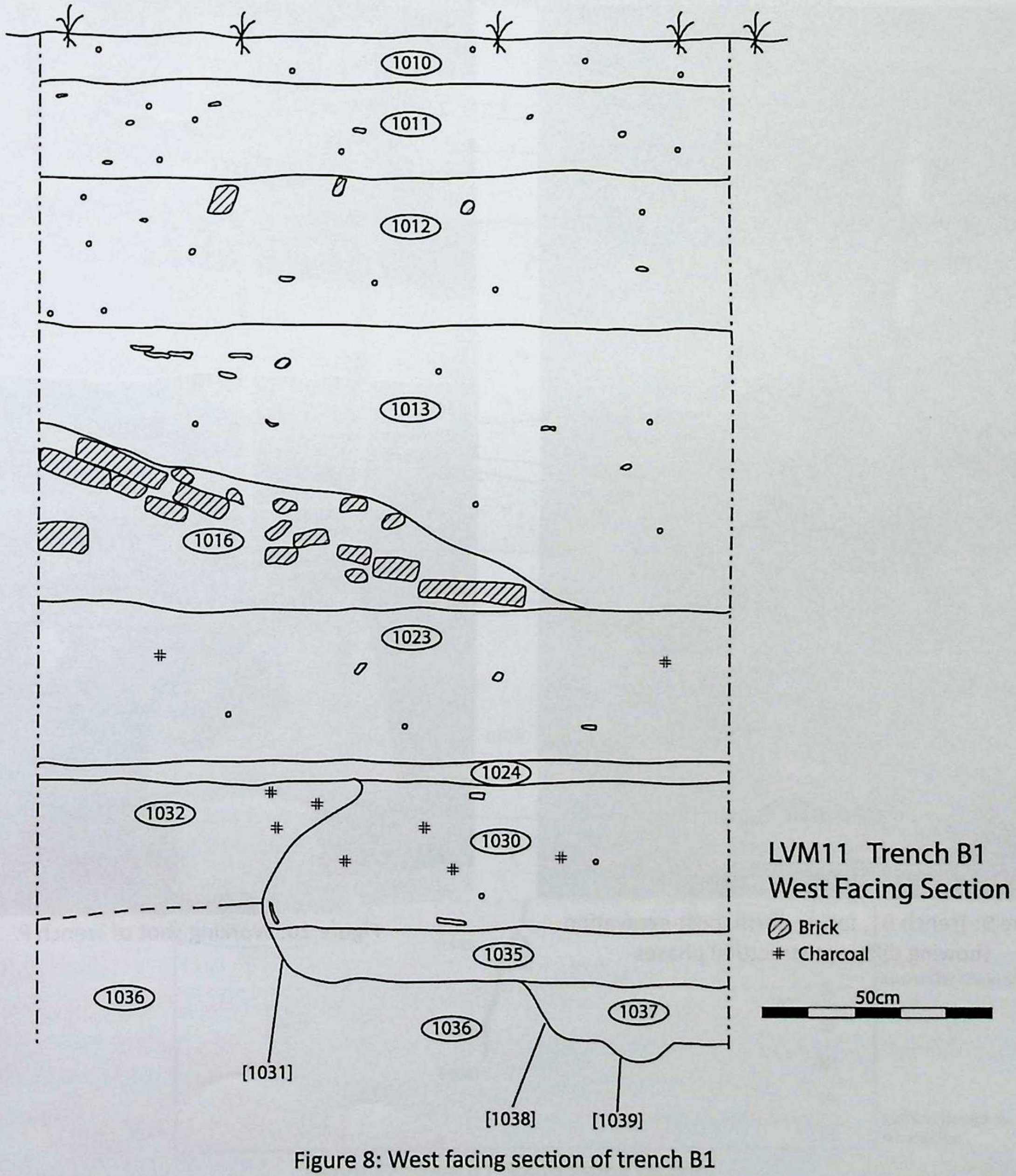
1010
1011
1012
1013
1016
1023
1024
1032
1030
1035
1036
1036
1037
[1031]
[1038]
[1039]
LVM11 Trench B1
West Facing Section
▨ Brick
# Charcoal
50cm

Figure 8: West facing section of trench B1

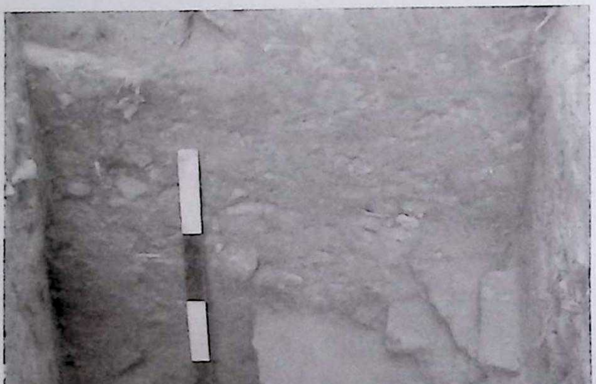

Figure 9: Trench B1, facing north, post-excavation showing different structural phases

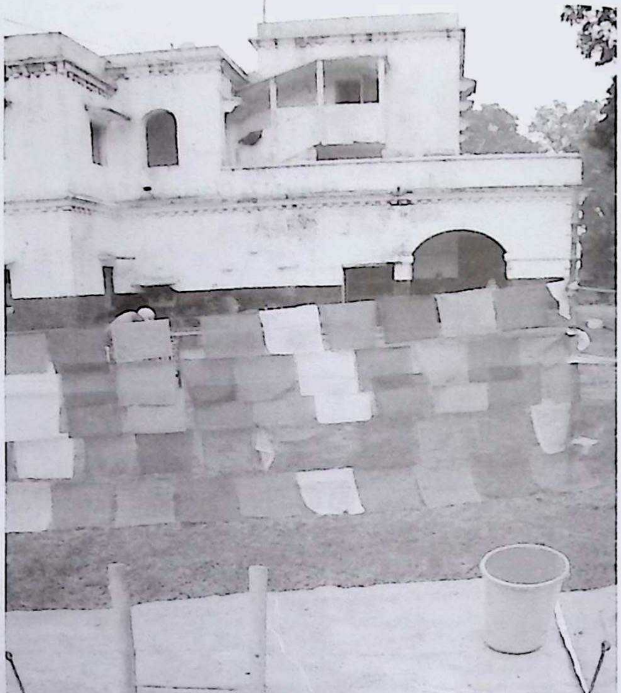

Figure 10: Working shot of Trench P.

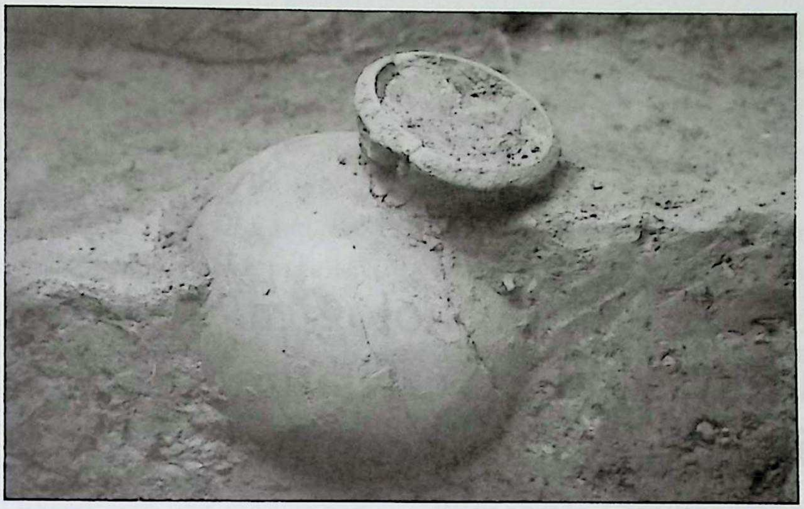

Figure 11: Complete ceramic vessel (image courtesy of Ira Block).

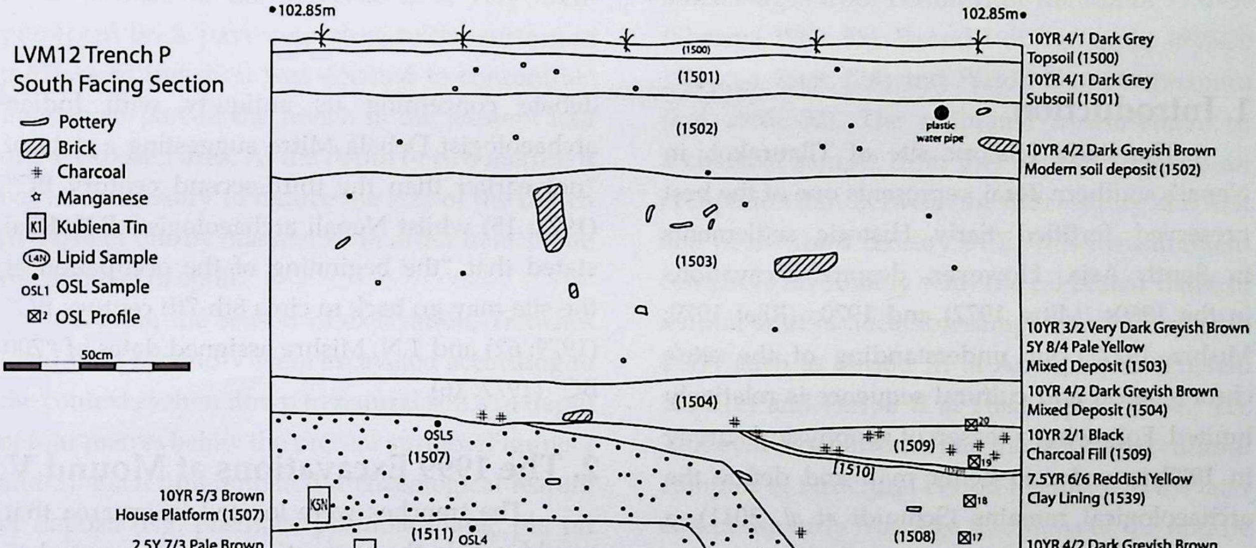
LVM12 Trench P
South Facing Section
Pottery
Brick
Charcoal
Manganese
K1 Kubiena Tin
L4N Lipid Sample
OSL1 OSL Sample
2 OSL Profile
50cm
•102.85m
102.85m•
10YR 4/1 Dark Grey
Topsoil (1500)
10YR 4/1 Dark Grey
Subsoil (1501)
plastic water pipe
10YR 4/2 Dark Greyish Brown
Modern soil deposit (1502)
10YR 3/2 Very Dark Greyish Brown
5Y 8/4 Pale Yellow
Mixed Deposit (1503)
10YR 4/2 Dark Greyish Brown
Mixed Deposit (1504)
10YR 2/1 Black
Charcoal Fill (1509)
7.5YR 6/6 Reddish Yellow
Clay Lining (1539)
10YR 4/2 Dark Greyish Brown
Cultural Deposit (1508)
2.5Y 7/3 Pale Brown
Old Land Surface (1518)
5Y 6/4 Pale Olive
Redeposited Natural (1523)
2.5Y 6/2 Light Brownish Grey
2.5Y 6/6 Olive Yellow
Fill of Pit (1536)
Mixed
Natural Clay - 25cm spit (1529)
Mixed
Natural Clay - 25cm spit (1540)
2.5Y 6/6 Olive Yellow
Natural Clay
10YR 5/3 Brown
House Platform (1507)
2.5Y 7/3 Pale Brown
Structrual Platform (1511)
2.5Y 6/2 Light Brownish Grey
2.5Y 6/6 Olive Yellow
Fill of Pit (1534)
(1500)
(1501)
(1502)
(1503)
(1504)
(1507)
(1509)
[1510]
(1508)
(1511)
(1518)
(1523)
(1534)
(1529)
(1536)
[1535]
(1540)
[1533]
(1532)
OSL5
OSL4
OSL3
OSL2
OSL1
K5N
K4N
K3N
L6N
K11N
K10N
K2N
L5N
K1N
L1N
K8A
K8B
L3N
root activity
root activity
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
21

Figure 12: Trench P South facing section.

Defining the Chronological and Cultural Sequence of Mound V, Tilaurakot: A Report on pilot excavations conducted in 1999

- Coningham, R.A.E., Acharya, K.P., Davis, C.E., Kunwar, R.B., Manuel, M.J., Tremblay, J., Strickland, K.M., McDonnell, G. and Bidari, Basanta

1. Introduction

The Early Historic site of Tilaurakot, in Nepal's southern Terai, represents one of the best preserved fortified Early Historic settlements in South Asia. However, despite excavations in the 1960s (Mitra 1972) and 1970s (Rijal 1979; Mishra 1977), our understanding of the site's chronological and cultural sequence is relatively limited. Following a season of geophysical survey in 1997 in order to better map and define the archaeological remains (Schmidt *et al.* 2011), a team of archaeologists were invited to conduct a preliminary archaeological excavation at the site in 1999 in order to support the preparation of a nomination for the site as part of a serial nomination of UNESCO World Heritage Sites associated with the life of the historic Buddha, Siddartha Gautama. Selected for study on account of its strong textual and archaeological links with the nearby UNESCO World Heritage site of Lumbini, the 1999 excavations were funded by UNESCO's World Heritage Centre and saw two trenches excavated at Mound V in order to define the chronological and cultural sequence of the site. In particular, the excavations were geared towards the production of an independent chronmetrically dated sequence for the site as there was some debate concerning its antiquity with Indian archaeologist Debala Mitra suggesting a date of "not earlier than the third-second century BC" (1972: 15) whilst Nepali archaeologists B.K. Rijal stated that "the beginning of the occupation at the site may go back to circa 8th-7th century BC" (1979: 62) and T.N. Mishra assigned dates of "700 BC" (1977: 16).

2. The 1999 Excavations at Mound V

The trenches were located in an area that would enable the excavation of a near complete sequence of the site's occupation. With this aim in mind, a trench was located next to one of Rijal's (1979) old trenches on Mound V, which had been sited at one of the highest points of the mounded site, some 3.5 metres above the surrounding fields (ibid.: 35) (Figure 1). The sequence from Rijal's earlier sondage suggested that the site's sequence went back to the first half of the first millennium BCE (ibid.). Being adjacent to the earlier trench also enabled a clear view of the sequence in section by cleaning the backfill out and using it as a vertical test trench. As noted above, the trenches were designed with one main objective in mind, to recover sufficient charcoal samples to allow the construction of an absolute chronology for the site. In meeting this aim, the trench was set out in order to be large enough to identify stratigraphic phases in addition to mixed deposits, well digging and other intrusive features - but also small enough to be covered by a roof to protect the excavation (and excavators) from the sun and rain and, of course, being small enough to finish within a single six-week season. The result was two cardinally oriented trenches, TLK99 Trench I and II cut into Mound V, and covering an area of 24.5 square metres - Trench I measuring four by 3.5 metres and Trench II four by 3.5 metres. The trenches were fully linked with one another and distinguished separately only for the labelling of finds. Due to the presence of a very well-preserved brick pavement close to the surface in the eastern trench, it was decided to concentrate the deeper part of the trench in the western half of the exposed area. At the depth of two metres, it became necessary to reduce the size of the trench to a size of one by one metres in order to facilitate the removal of spoil.

During the season of excavation, Trenches I and II on Mound V were excavated according to the context system down to natural soil at a depth of four metres below the present surface (Figures 2 and 3). Each differentiated archaeological feature or deposit (e.g. posthole, posthole filling, pit, pit filling etc.) was given a unique context number. The results of the excavation were divided into a sequence of 8 structural periods, I - VIII. The following description is given in reverse order of excavation, with the earliest structural period described first.

2.1 Structural Period I

Above the natural soil, the earliest in situ evidence of human occupation in the immediate location of Mound V's trenches I and II was represented by the deposition of a thick clay layer. This context contained numerous flecks of charcoal as well as seven special finds, including slag, an unidentified terracotta object, 37 sherds of Grey Ware (some of which have a black slip) and three sherds of Painted Grey Ware (PGW). Whilst one of these was a small sherd with a single stroke of black paint running across one edge (Figure 4), two other sherds fit together and form a large section of the base of a grey ware tali-shaped vessel. Although the exterior or base of the vessel was undecorated, the interior was treated with a series of long angular strokes, some of which were double. It is interesting to note how this angular decoration differs from the more angular style on the bases of PGW vessels from Hastinapura (Lal 1955: 37 and 41). The presence of Painted Grey Ware sherds, Grey Ware sherds and Grey Ware sherds with a black slip compares closely to the assemblages from Period II of Kausambi 1957-59 (Sharma 1960: 58), Period I of Kausambi 1949-50 (Sharma 1969: 128) and Period II of Hastinapura (Lal 1955: 32). The calibrated measurement of a charcoal sample from this deposit suggests an occupation date between the fifth century and first half of the third century BCE. This measurement compares favourably with the calibrated dates of a number of radiocarbon samples associated with PGW such as Period III at Atranjikhera (Possehl 1994:12) and Period II at Hastinapura (ibid.: 42). This evidence indicates that the associated cultural complex of Structural Period I belongs to the later end of the early Iron Age traditions of the middle Ganga with a radiocarbon boundary of the fifth century BCE.

2.2 Structural Period II

The features of Structural Period I were sealed, thus starting a repetitive sequence of what has been interpreted as the deposition of a clay palaeosurface, followed by the construction and subsequent destruction of a metal-working furnace or oven construction. The ceramics from structural period II included 30 sherds of Grey Ware, three sherds of grey ware vessels with bands of black paint along the edge of both sides of the rim and a sherd of a red slipped ware. Cord Impressed Ware (CIW) ceramics were also identified contexts within this early phasing of the sequence (Figure

5), which were also identified at Gotihawa (Verardi 2007) and in the earliest levels of the village mound at Lumbini (Strickland *et al.* in press a). Other special finds included grinding stones, slag, a fragment of a terracotta figurine, a clay sealing, a crucible and an unidentifiable iron object. Four radiocarbon samples were measured and gave calibrated dates of between the fourth and second century BCE. It is interesting to note that the earlier of the dates compare very favourably with those from Period III at Narhan, which also possesses similar cord impressed red wares (Singh 1994: 25-6). Another measurement, however, gave a much earlier date than surrounding contexts, indeed, calibrating to between either 760 and 690 BCE, or between 540 and 370 BCE, at 95% confidence. In view of the large quantities of grey ware within this context and its earlier date, it is thought likely that this context contains redeposited material from earlier contexts. Indirectly, it also suggests that there are some much earlier areas of occupation in the immediate vicinity of Mound V - which were then redeposited several centuries later. Indeed, such a hypothesis is supported by our recalibration of two earlier radiocarbon dates from Tilaurakot published by Possehl (1994: 116) and in *Radiocarbon* volume 11.

2.3 Structural Period III

There is relatively little information available concerning Structural Period III as it yielded few finds – none of which were diagnostic. Those finds included sherds of Grey Ware, an agate bangle, a damaged stone bead, a damaged terracotta bead and slag. No samples for radiocarbon measurements were available for this structural period.

2.4 Structural Period IV

The most complete structure encountered during the excavation was exposed during the excavation of the features of Structural Period IV. The structures of period III were sealed by clay floors with a timber superstructure, represented by postholes, erected - complete with adjacent fireplace, furnace and ring well (Figure 6). Special finds from this period included terracotta beads, terracotta bangles, clay sealings, a spindle whorl, a horn stylus (Figure 7), some residual sherds of very coarse grey ware, a copper alloy object, an iron object, glass fragments, an oil lamp, grinding stones, decorated sherds, slag and a single sherd of Northern Black Polished Ware (NBPW). Of these special finds, a number are fairly diagnostic such as a stamped red ware sherd which has similarities with stamped wheels, spokes and dots from early levels of Period III at Hastinapura, between the early sixth century and third centuries BCE (Lal 1955: 57). A single sherd of NBPW was recovered but layers across India with such sherds have variously produced radiocarbon dates stretching from eighth century BCE to the first century CE (Possehl 1994). A radiocarbon sample from levelling debris produced a date of between the first and second century BCE - a date range that would agree with the later part of Erdosy's late NBP dates (1995: 105).

2.5 Structural Period V

Structural Period V was, like Structural Period III, a single structural episode. An old land surface was deposited and a deep pit cut into it, which was then subsequently filled. Despite being limited in terms of activities, the contexts of Structural Period V yielded a total of 23 special finds, including terracotta beads, iron objects, a rounded sherd, a terracotta animal, a glass bead, a copper object and decorated sherds. These included a red ware sherd with a black linear painted decoration on its exterior, a type found in the levels of Mitra's Period I (1972: 22) and sherds with triangular notches incised below circular rings around the neck of the vessel, also identified by Mitra (1972, 22). Better dated analogies may also be found from the excavations at Hastinapura where Lal identified decorated sherds within Period IV dated to between the early second century BCE and the late third century CE (Lal

1955: 12A). A single radiocarbon sample from the fill of a pit in this period provided a date of between the first century BCE and the second century CE and corresponds to Lal's broad dating range.

2.6 Structural Period VI

Structural period VI contains the final distinct structural activities on Mound V and has been divided into three sub-phases, A, B and C. Whilst the first two relate to the initial construction of a brick structure and its subsequent remodelling, the final phase represents the digging of postholes into its brick pavement (Figure 8). Special finds included slag, terracotta beads, rounded sherds, a grinding stone and decorated sherds and a stamped sherd appears to be very similar to the stamped varieties from Hastinapura Period IV (Lal 1955: 63) - suggesting that there is continuity through the upper part of the sequence at Mound V. Two radiocarbon samples from Structural Period VI were measured, one from the foundations of the original brick structure and the other from the fill of a posthole cut into the raised brick pavement - providing a date range of between the first century BCE and the third century CE.

2.7 Structural Period VII

The composite brick and post structure of Structural Period VI was abandoned and a thin sandy clay humus built up above it. This thin humus contained 18 special finds including slag, a grinding stone, glass, stone and terracotta beads. The most diagnostic artefact recovered was a small handmade female terracotta head which is stylistically similar to examples identified as Kushan by Rijal (1979: 46). As it was recovered from a position directly on the brick pavement, it is probable that we may assign the abandonment of Mound V to the Kushan period.

2.8 Period VIII

The final period of activity consists of the twentieth century archaeological activities of the Department of Archaeology, Government of Nepal. B.K. Rijal cut a trench into Mound V during his excavation seasons of 1974 and 1975. The eroded edges of his trench were clearly visible within our own trench and we even recovered one of his trench pegs (Sf 90), which was in an extremely well-preserved state. From a mixed deposit, a sherd of Grey Ware was also recovered, originating from the base of the sequence. The sherd belongs to a well-levigated tali-shaped vessel with a diameter of 14 centimetres, has band of black paint along the edge of both sides of the rim and is similar to those published by Mitra (1972: 23).

3. Metal-work analysis

In addition to excavations, specimens of metal-working debris were submitted to the Ancient metallurgy Research Group, Department of Archaeological Sciences, Bradford University, UK, for identification. The slags were visually examined and the classification was solely based on morphology where diagnostic slags and non-diagnostic residues were identified. Some samples were also subjected to X-ray Fluorescence (XRF) analysis. Diagnostic slags can be attributed to a particular industrial process; these comprise the iron-working slags, i.e. smelting or smithing slags, and non-ferrous working debris. The second group, the non-diagnostic residues, could have been generated by a number of different processes but show no diagnostic characteristic that can identify the process. In many cases, the non-diagnostic residues e.g. hearth or furnace lining, may be ascribed to a particular process through archaeological association. Residues from non-ferrous metal-working was also examined and analysed.

3.1 Iron-Working Residues

It is generally assumed that iron-working slag recovered from an excavation is smithing slag unless proved otherwise but some forms of smelting slag are difficult to distinguish from smithing slag. However, despite this problem no iron smelting slag was identified at TLK99 and therefore, there were two types of iron-working slag identified in the Tilaurakot assemblage:

Smithing Slag (Slag) - randomly shaped pieces of silicate slag generated by the smithing process. These slag pieces are not typical of other iron smithing slags, and require further study to confirm their identification.

Hammer Scale (HS) - Spheroidal droplets of slag or iron scale (i.e. oxidised iron) formed during the smithing process. Indicative of fire welding, i.e. welding two pieces of iron (or e.g. steel) together.

There were also two types of non-diagnostic residues present:

Hearth Lining (HL) - the vitrified clay lining of a hearth or furnace. It is normally formed in the tuyere, air-inlet, zone.

Cinder (CIN) - a high silica slag that can either be formed by high temperature reaction between silica and ferruginous material. It can be ascribed to either the non-diagnostic slags or the diagnostic slags depending on its iron content and morphology.

3.2 Other Residues

A single crucible fragment from Tilaurakot indicated that copper alloys were melted, presumably to cast objects but there is no evidence for the smelting of these metals. Secondary copper (alloy) working requires a hearth with bellows to melt the alloys, the melting point depends on the alloy composition, but is of the order of 900-1000oC. The unmelted metal or alloy was placed in a crucible, probably sealed with charcoal to stop oxidation of the metal, heated until melted and then poured into a mould. Crucible fragments can survive but moulds are temporary artefacts, made of sand or poorly fired clay and therefore do not normally survive well in the archaeological record. Thus, there is often very little evidence for the type of artefact being produced.

3.3 Summary

A preliminary examination of the Tilaurakot metal-working debris assemblage indicates that iron smithing and copper alloy-working had been practised on the site. The material classified as smithing slag only occurs as small fragments, and has uncharacteristic vitrified surfaces. The material identified as non-diagnostic cinder, represents the largest proportion of materials by mass and count. It cannot be associated with any particular industrial activity and may sometimes be considered to be an 'accidental' product of pyrotechnology, or accidental high temperature fires. Some of this material was examined by XRF to assess the presence of non-ferrous metals but nothing significant was detected. The only definite evidence for non-ferrous working, the crucible fragment, was also analysed by XRF and copper was detected as the major non-ferrous element and a small amount of tin was detected. This probably suggests the casting of low tin bronzes. In conclusion the quantity of material is small, possibly indicating that this material represents a background scatter of metal-working debris deriving from metal-working activities occurring elsewhere on the site and not in the areas excavated. The metal-working within the fortified area of Tilaurakot is in stark contrast to that without, where at the southern industrial mound a high density of metal-working activity occurred, including the presence of possible smelting furnaces (Strickland *et al*. 2016b).

4. Conclusion

To summarise, we may identify the following characteristics of the sequence excavated in the vicinity of Mound V at the site of Tilaurakot. Firstly, we may suggest that although the in situ occupation at Trenches I and II dates to the early fifth century BCE, there is redeposited evidence from Structural Period II, which suggests an earlier occupation comfortably into the first half of the first millennium BCE. This is supported by the sequence at the southern industrial mound, where we find evidence of cultural activity before the sixth century BCE creation of a low artificial mound. The cultural characteristics of the earliest in situ occupation in the Mound V sequence includes a number of fine, well-levigated well-fired Grey Ware sherds, some of which are decorated with black paint. It is important to note that these sherds all have thin section walls and are fine; thus being quite different to the coarse grey wares reported from layers usually associated with NBPW such as at Hastinapura Period III. Indeed, the decoration on the two joining sherds is different from those PGW sherds described by Mitra as being "indifferently-painted" (1972: 23). It is clear that Mitra's statements that "the possibility of finding classic examples of Painted Grey Ware or of isolating its pre-N.B.P. phase elsewhere, if not on the site, cannot be entirely ruled out" (ibid.) has now been met with such a clear example. Although the Tilaurakot decoration is far from Hastinapura's concentric ring decorations (Lal 1955: 41), it does have parallels with Atranjikhera's sets of parallel lines converging and intersecting on bases (Gaur 1983: Figure 42).

The other cultural characteristics shared with Hastinapura's Period II, the PGW levels, include the absence of burnt brick but the presence of copper and iron-working slag and sherds of black-slipped grey wares (Lal 1955: 12A). As also mentioned above, the range of radiocarbon measurements between the early fifth century and the fourth century BCE conform favourably with other measurements for levels associated with PGW from Atranjikhera Period III and Hastinapura Period II (Possehl 1994: 12 and 42). Around the same time, fourth to third centuries BCE, iron-smelting activity to the south of the ancient city intensified, with greater quantities of slag being dumped, and the further raising of the surface level of the mound. It may thus be stated that we have in situ evidence for occupation at Mound V by the fifth century BCE, and even earlier in the light of the re-calibrated radiocarbon date from TLK VI with dates of c. 550 BCE and the beginning of the first millennium BCE. As a result, we may firmly refute Mitra's statement that occupation at the site "is certainly not earlier than the third century BCE and is most probably not later than the second century BCE." (1972: 18).

Occupation in the vicinity of the trench continued without the flood and conflagration noted at Hastinapura by Lal (1955, 12A), providing clear artefactual continuity into our second structural period. Affinities between the Cord Impressed Wares from Tilaurakot, Gotihawa and Narhan have already been made, which again support the radiocarbon dating for the sequence. The next significant cultural characteristic noted are the terracotta ring wells dug into Structural Period III and IV. Classed by Allchin as "typically Gangetic" (1995: 131), they are commonly associated with Northern Black Polished ware and copper coins (ibid.: 136) and form one of the key features of Hastinapura's Period III (Lal 1955: 12A). Structural periods V, VI and VII are typified by the presence of stamp-impressed ceramics, the use of fired bricks, a terracotta wheel and a Kushan-style terracotta head. All these cultural objects are key features of Period IV at Hastinapura which was dated by Lal to between the early second century BCE and the late third century CE (ibid.).

This range compares well with those from the trench itself, which ranges between the first century BCE and the third century CE. This date for the abandonment of the site also compares well with the date of the third century CE proposed by Mitra (1972: 15). It should also be noted, however, that a further re-calibrated radiocarbon date from earlier excavations at the site has provided a date of between 780 and 1220 CE at 95% confidence, suggesting an intermittent survival of occupation into the medieval period. It is notable that the younger element of this date range is almost contemporary with the pilgrimage of King Ripu

Mala of western Nepal, who left an inscription in Tilaurakot's vicinity at Niglihawa and another at Lumbini itself demonstrating an understanding of the Buddhist sanctity of the area in the fourteenth century CE.

In conclusion, it may be stated that the excavations at Mound V at Tilaurakot have refuted Mitra's statement that there was no occupation earlier than the second or third century BCE. Direct evidence from TLK99 attests occupation of the early fifth century BCE and the indirect evidence indicates a date as early as the sixth or even eighth century BCE. Furthermore, the re-calibrated dates from earlier excavations at the site have provided additional support with one date of c. 550 cal BCE and another of the beginning of the first millennium BCE. This is further supported by early dates of the sixth and fifth centuries BCE for the two phases of wooden palisade and early occupation sequences at the northern rampart of Tilaurakot, excavated in 2013 and 2014 (Davis *et al.* in press) as well as the presence of levels at the base of Mound I with dates of the seventh century BCE from our excavations in 2015.

In addition to the chronological evidence, the artefactual record from this area of Tilaurakot is of further interest in discussions of the urban morphology of the city. Whilst earlier geophysical survey at the site had suggested the presence of cardinally-orientated streets across the city (Schmidt *et al.* 2011), later geophysical survey conducted between 2013 and 2016 has confirmed this patterning, with the further identification of a large walled complex at the centre of the site (Coningham *et al.* 2015). Unbeknown at the time of excavations in 1999, the TLK99 trenches are located within the south-west corner of this large monumental compound. Whilst the evidence from these excavations highlights Tilaurakot's cultural affinity with sites within the Gangetic plain and Early Historic world, it is also of note the quality and character of some of the artefacts recovered during these excavations. For instance, the discovery of a stylus of antler may suggest the potential for administrative functions in this central area of the site and further excavations are required within this part of the site to further elucidate the nature of human activity, from its earliest occupation through to the later phases of the site.

5. Acknowledgements

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7. Figures

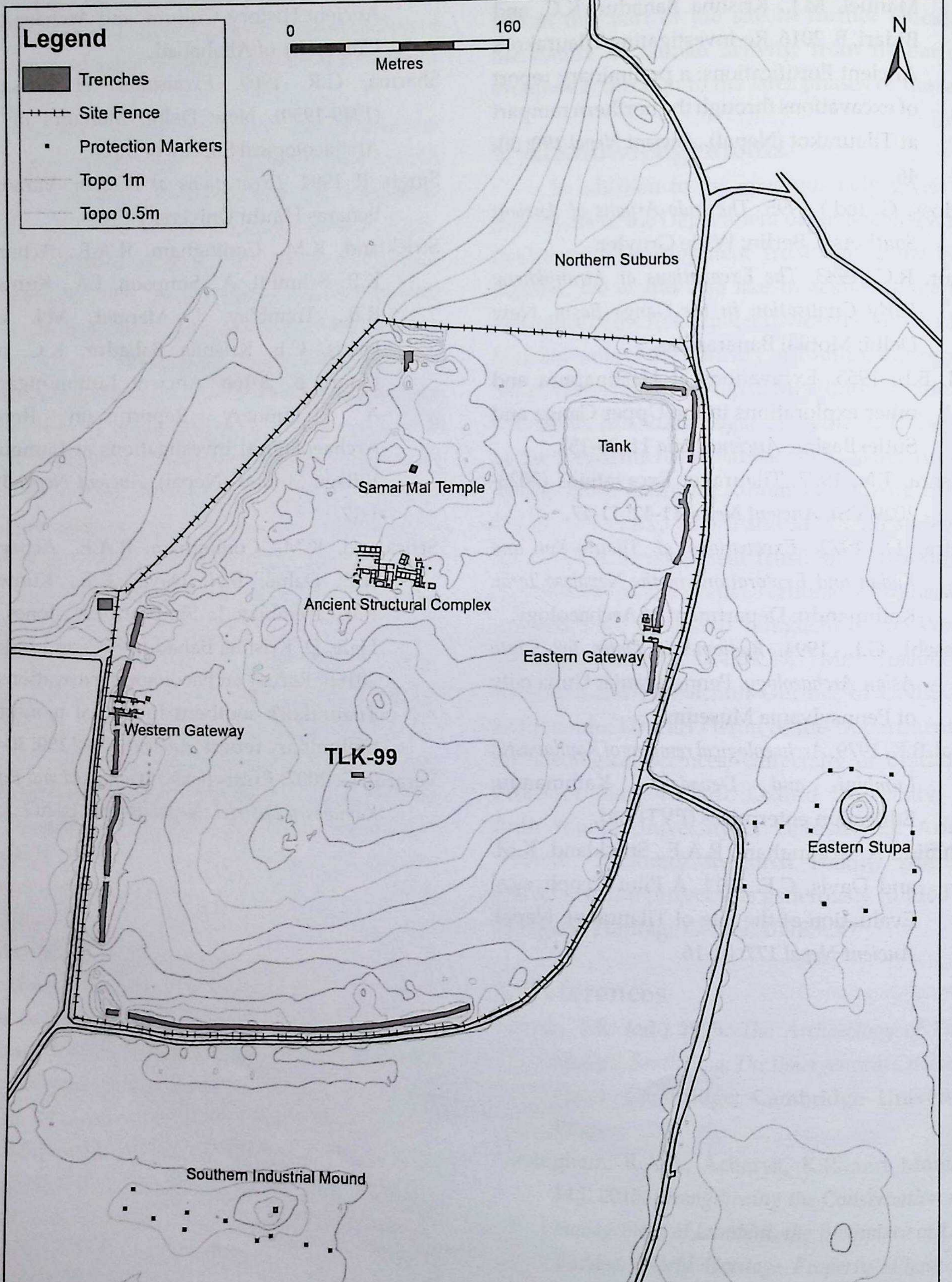

Legend
Trenches
Site Fence
Protection Markers
Topo 1m
Topo 0.5m
0
160
Metres
N
Northern Suburbs
Tank
Samai Mai Temple
Ancient Structural Complex
Eastern Gateway
Western Gateway
TLK-99
Eastern Stupa
Southern Industrial Mound

Figure 1: Location of Trenches I and II, TLK99.

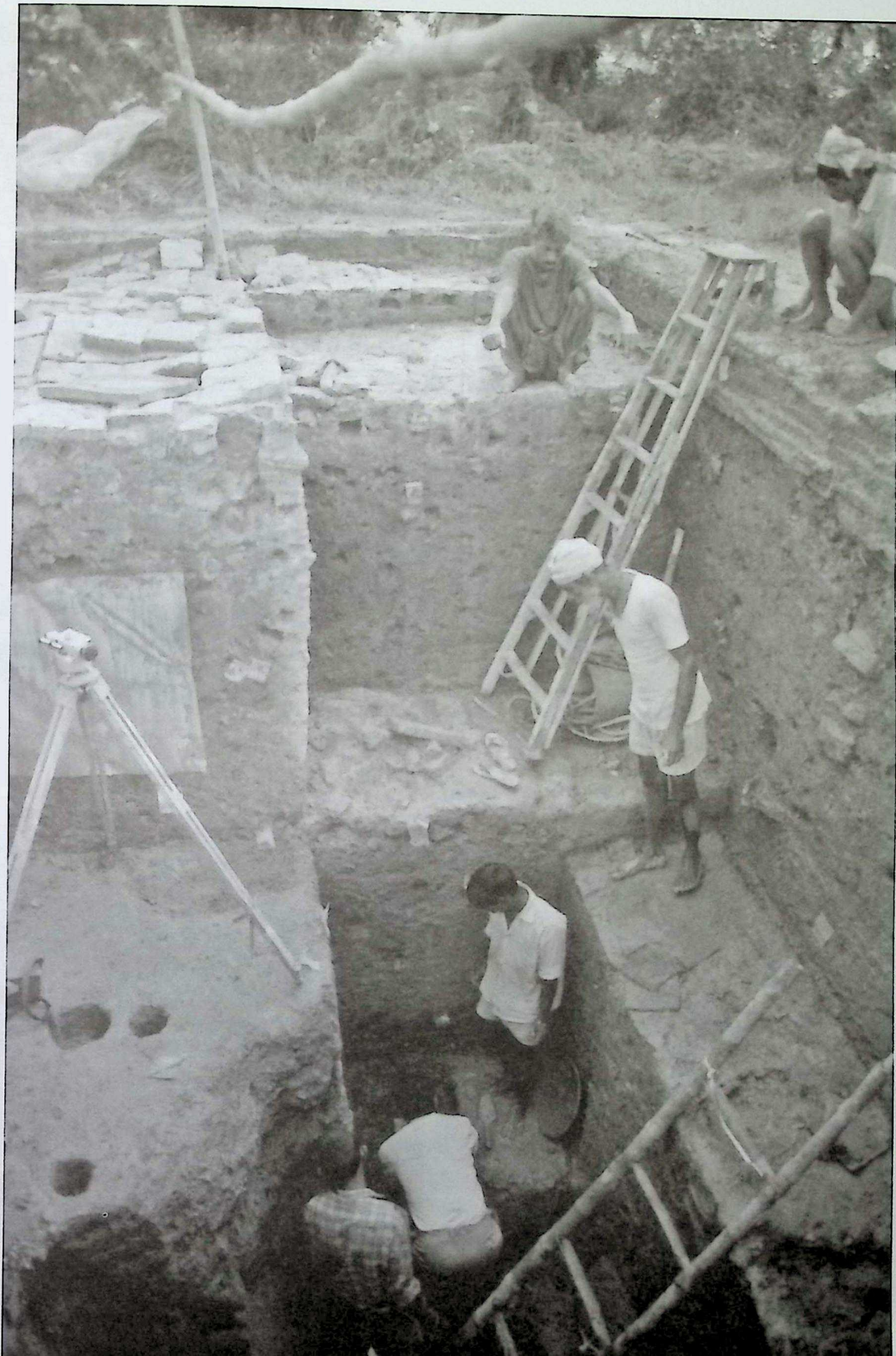
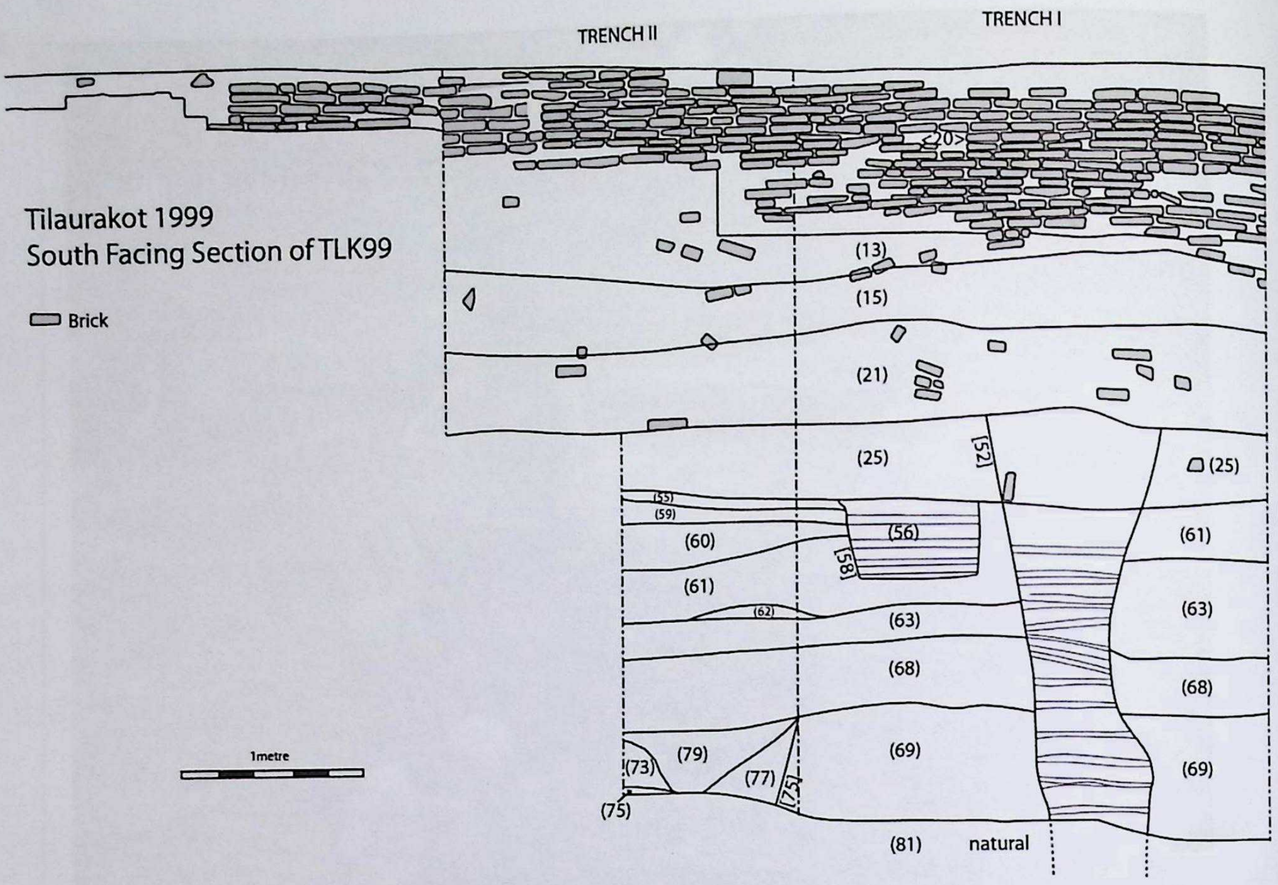


Figure 2: Working shot of the excavations at Trench TLK99


TRENCH II
TRENCH I
Tilaurakot 1999
South Facing Section of TLK99
Brick
1metre
<20>
(13)
(15)
(21)
(25)
[52]
(25)
(55)
(59)
(60)
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[58]
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(68)
(73)
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[75]
(75)
(69)
(69)
(81)
natural

Figure 3: South facing section of TLK99 Trenches I and II.

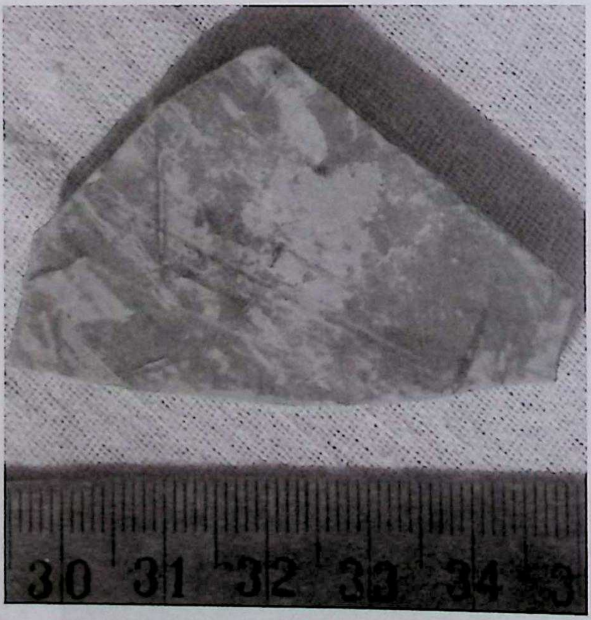
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Figure 4: SF185 Painted Grey Ware from Context 69

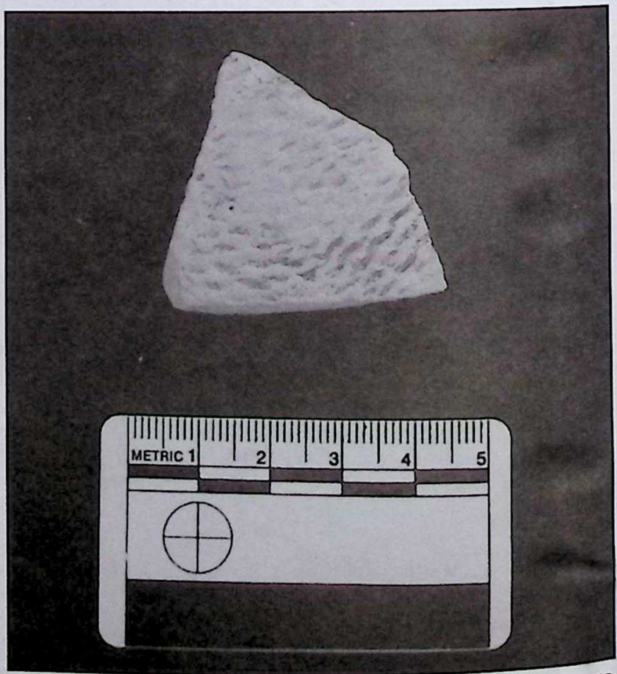
METRIC 1
2
3
4
5

Figure 5: SF277 Cord Impressed Ware from context 60

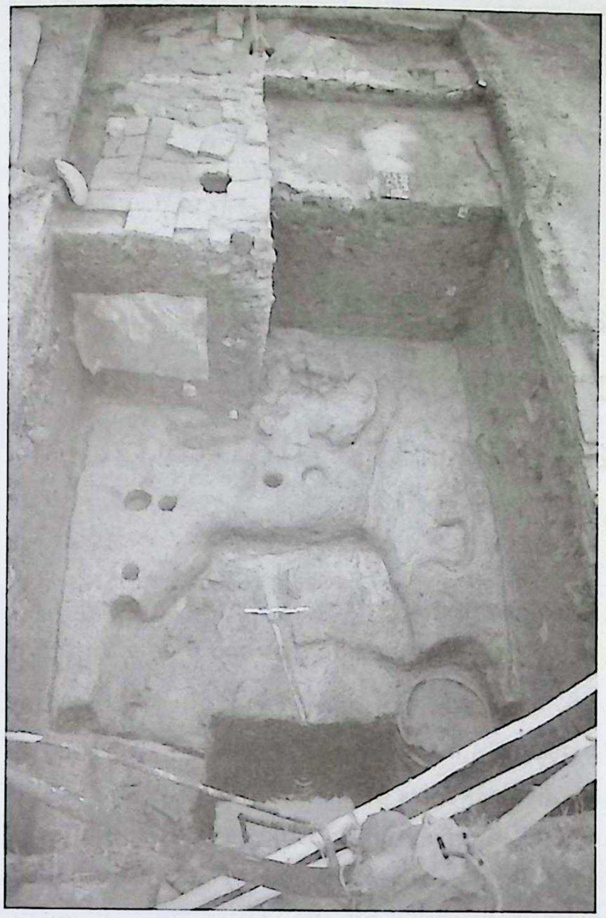

Figure 6: Postholes cut into occupation surfaces in Structural Period IV

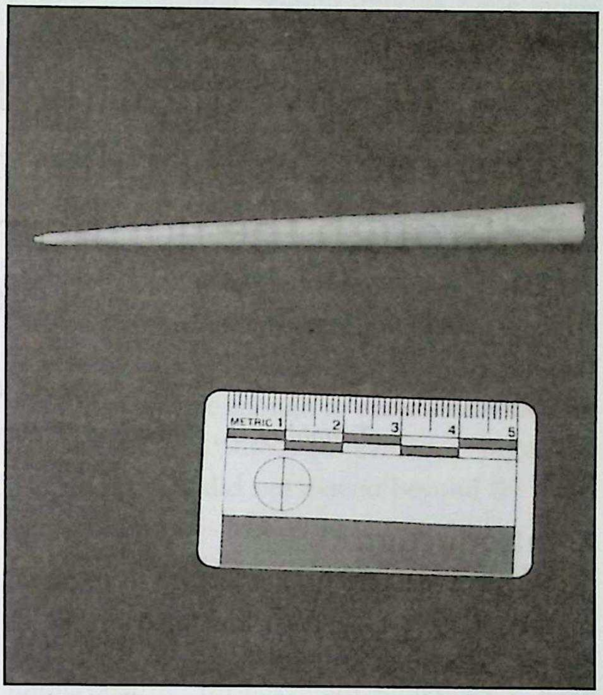

Figure 7: SF100 polished antler stylus from context 25.

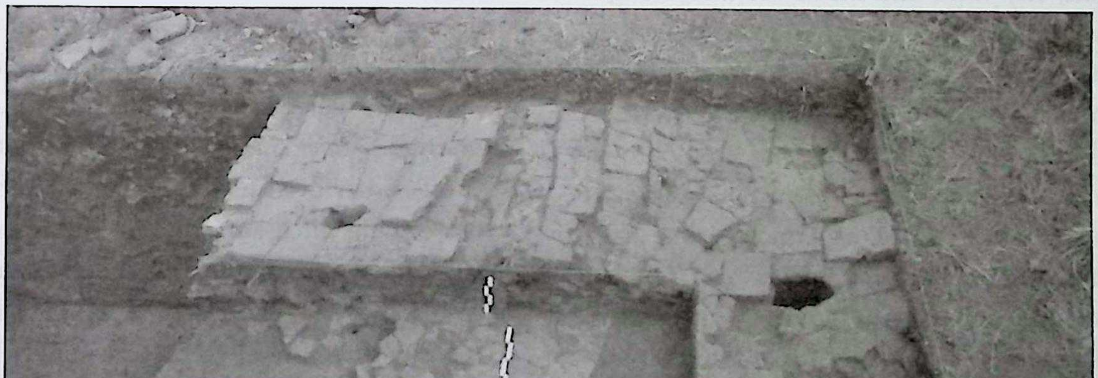

Figure 8: Postholes cut into paving in upper surfaces of TLK99

Re-investigating Tilaurakot's Ancient Fortifications: a preliminary report of excavations through the northern rampart at Tilaurakot (Nepal)

- Davis, C.E., Coningham, R.A.E., Acharya, K.P., Simpson, I.A., Tremblay, J., Kunwar, R.B. Manuel, M.J., K.C., Krishna Bahadur and Bidari, Basanta

1. Introduction

Urban settlements defined by fortification complexes have long been identified as one of the key indicators of the emergence and spread of the Early Historic Tradition across South Asia (Coningham 1995). Whilst performing defensive functions, city walls and moats are also thought to have prevented disruption to a settlement from natural forces, such as erosion and flooding (Narain and Roy 1977: 7, Coningham 1999: 54), as well as protecting settlements and crops grown within a city's boundary from wild animals (Coningham 1999: 56). Furthermore, some have argued that ramparts and moats also fulfilled symbolic functions and a number of settlement layouts have been thought to exhibit cosmo-magical symbolism (Wheatley 1971: 481), with urban forms constructed as microcosms of the universe. Indeed, there are a number of South Asian examples where urban rampart and moat complexes are believed to have formed key cosmological motifs, representing the ocean and mountain range surrounding the universe (Coningham 2000). With a central role thus implied for the royal palace as representing Mount Meru, the dwelling of the Gods at the centre of the universe, this also portrayed the temporal ruler as a universal ruler or *chakravartin* (Wheatley 1971: 437, Coningham 2000: 350). Early Historic texts, such as the *Arthasastra* and *Manasara,* provided clear instructions for the construction of moats and ramparts, with the *Arthasastra* stating that a city should be quadrangular, surrounded by three moats and a rampart {Arthasastra 2.3.4-6} and be internally demarcated by cardinally orientated roads and gateways {Arthasastra 2.4.1-2}. Similarly, the *Manasara* suggested that cities should be furnished with a quadrangular wall with an accompanying ditch surrounding the settlement with a gate at each cardinal direction {Manasara 9.107-109}. It is now clear from its urban plan, that Tilaurakot, in southern Nepal, seemingly aligns with these precepts as it possesses an almost quadrangular fortification (Figure 1) and the results of recent geophysical survey suggest that cardinally-orientated roads were laid out in a grid within the city (Coningham *et al*. 2015).

2. Previous investigations of the ramparts at Tilaurakot

The first excavation of a section across Tilaurakot's ramparts was undertaken by P.C.

Mukherji of the Archaeological Survey of India in 1899 (Mukherji 1901). He cleared and mapped the entire rectangular walled site and its immediate environs, stating that "The mounds of the ruined walls are easily distinguishable on all the four sides" (ibid.: 19). From his investigations, Mukherji asserted that Tilaurakot was initially a mud fort, which was subsequently elaborated with brick walls. In addition, he noted that the rampart circuit had been damaged by the river on the north-western edge in "ancient times" (ibid.) and that the site was surrounded by a deep ditch, a second mud wall and a further wider ditch. He undertook limited excavation either side of the northern brick rampart, towards the eastern portion of the northern rampart, and near the eastern gateway. From this limited excavation, he noted that the brick rampart was between 10 to 12 feet (3 to 3.6 metres) wide. He also noted that the rampart's foundation was built in mud and attributed the outward slope and collapse of the later phase of brick walls to this original construction method (Mukherji 1901: 19). It would also appear that Mukherji identified brick walls running internally from the main fortification and hypothesised that these potentially represented square bastions. However, limited time did not allow him to excavate these features further, although he did identify what he thought was an inner guard room within a cleared section of wall (ibid.).

The next major archaeological intervention occurred in 1962, when joint excavations were conducted by the Department of Archaeology, Government of Nepal and the Archaeological Survey of India. Directed by Debala Mitra, a Trench - TLK-1, was cut across a portion of the north-west rampart during a single season (1972: 1). Measuring 32 metres by six metres on a north to south orientation, Mitra selected this section of rampart as it was the highest preserved portion of the circuit, only 0.28 metres lower than the highest point of the highest occupation mound within Tilaurakot (ibid.: 11). The maximum thickness of the archaeological stratigraphy between the natural and the highest course of the brick fortification was 3.9 metres (ibid.: 14). Mitra divided this sequence into three main phases, in order of antiquity, IA and IB - pre-fortification, II - mud-rampart and III - brick fortification. Significantly, as these labels suggest, she suggested that the lowest two metres of layers visible in her long east-facing section, phases IA and IB, were deposited prior to the construction of the site's fortifications, stating that occupation at Tilaurakot "is certainly not earlier than the third century BC and is most probably not later than the second century BC." (ibid.: 18). Mitra also noted that the accumulation of artefacts before, and after, the building of the clay rampart was not extensive enough to draw a firm date for its construction, although evidence suggested that occupation did not extend beyond the third century CE in this area of the site (ibid.).

Eliciting almost immediate controversy as Mitra's suggested third century date discounted Tilaurakot as a possible candidate for ancient Kapilavastu, further investigations were undertaken soon afterwards by the Government of Nepal in order to provide additional archaeological sequences and artefactual dating evidence. Excavations conducted by Tara Nanda Mishra were thus sponsored from 1967 onwards and one of the areas identified for investigation was a central portion of the western rampart. Mishra identified three phases of rampart construction in this location, including an early clay rampart, which he assumed had been constructed with material dug out of a contemporary moat. He dated this phase to between the seventh and sixth centuries BCE based on finds of Northern Black Polished ware (NBPW) and Painted Grey ware (PGW). The second phase of rampart was dated to 200 BCE and also constructed of clay but was topped by a final phase, represented by a brick built wall (Mishra 1977: 16). Mishra also successfully exposed a gateway on the western side of the city wall with a sequence running from the second century BCE to the second century CE (ibid.: 17). Full reports on these early excavations are still awaited but, more recently, the Lumbini Development Trust (LDT) undertook a campaign of excavations at various points around Tilaurakot's circuit of brick fortifications. These excavations were concerned with the exposure, conservation and presentation of the city walls rather than providing chronological sequences, and are also yet to be published.

In view of the paucity of fully published excavation reports and the uncertainty of relying on relative chronologies, most of which utilised ceramic typologies, a fresh campaign of two seasons of excavations were focused on the northern rampart of Tilaurakot. Articulated with the Japanese-Funds-in-Trust for UNESCO program of investigations at the city, our new fieldwork provided the opportunity to fully excavate a scientifically dated sequence for the fortification in this locality. Designed to link with Mitra's previous investigation of the city wall and rampart, it has further enhanced our understanding of the character and development of Tilaurakot's urban form.

3. Excavations at Trench R

Two seasons of investigations were focused on the northern rampart of Tilaurakot at Trench R in 2013 and 2014. As one of our major research questions was the validity of Mitra's chronology and her phasing of the rampart, our first season of excavations aimed to locate and recut Mitra's Trench TLK-1, close to the north-west corner of the city walls (Figure 2). In her report, Mitra stated that she had intended for her original trench to measure 28 metres north to south and six metres east to west. Due to a stated shortage of time, her trench was reduced to a width of 2.75 metres south of the brick fortification wall. However, Mitra then extended her trench to the north by four metres in order to incorporate archaeological material beyond the rampart into the ditch, thus increasing the north to south axis to 32 metres. She further adjusted her trench dimensions by reducing its width to 1.22 metres wide north of the brick wall. Most significantly, Mitra decided to leave the majority of the brick wall intact and thus left a major 3.6 metre wide and 3.4 metre deep baulk unexcavated below the brick wall (Mitra 1972: 11). As became clear from studying her published section (ibid.: Plate II), this left the most critical central area of her fortification sequence unexcavated beneath the youngest part of the section, its final, brick-built wall – a sequence which might have hosted an earlier phase of fortifications.

In order to reinvestigate this missing portion of Tilaurakot's defensive sequence, we decided to empty Mitra's old trench on either side of the brick wall and then cut down through the wall and into her unexcavated central baulk in order to link the northern and southern portions of her east-facing section. This also allowed us to link the scientifically dated and artefactual sequence from our new investigations with Mitra's report, which lacked such absolute dating techniques but provided a wealth of artefactual evidence. This was the first time that the full defensive sequence at Tilaurakot had been completely cut through, including the brick wall. During our second season of investigations in 2014, we decided to extend our 2013 vertical slot as, having providing a deep sequence, we now wanted to expose and characterise more fully the structural sequence of fortifications (Figure 3). The following report will combine the findings of both the 2013 and 2014 seasons and the archaeological sequence is subdivided into six phases for ease of discussion. The following description is given in reverse order of excavation, with the earliest structural period described first.

3.1 Phase 1

The natural soil at the base of the sequence, context (167 = 261), was a mottled yellow clay, with inclusions of manganese and kanker. The earliest evidence of human activity was represented by the trampling of material, mainly consisting of ceramics, into the surface of the natural. This trampled natural was cut by, and contained, several features (Figure 4). Although we have yet to ascertain their exact function, they were undoubtedly caused by early human activity within this area of the site. The trampled natural was overlain by a thin pale, fairly sterile material, which was found below a dark coloured silty loam and fine sandy silt loam. The dark colour of this soil and the frequent mottle of colours led to the interpretation that this was a wet alluvial soil that was amended and cultivated. Optically Stimulated Luminescence (OSL) determinations were taken from soil samples throughout the exposed archaeological stratigraphy, and an OSL sample from context (162), a sediment associated with early agricultural activity, provided a depositional age of 620 ± 170 BCE (Kinnaird *et al.* 2015).

3.2 Phase 2

We then identified a discernible transition from agricultural derived deposits to what may be described as urban occupation. This lower urban phase of the stratigraphy is predominantly composed of sandy silt sediments, comparable to Banaganga river channel sediments. The occasional occurrence of medium rounded and sub-rounded stones in these sediments indicates that river sediments may have provided a significant contribution to the formation of this early stratigraphy, suggesting that the earliest phases of human settlement were heavily influenced by the river channel flooding and ground water wetness. Sediments relating to the transition to urbanism from agricultural derived deposits dated to the sixth century BCE, with samples taken from the upper and lower portions of this context (158) – R1 in geoarchaeological analysis and equal to context (273) - dated to 570 ± 130 BCE and 580 ± 150 BCE for the strata directly overlying the transition surface (Kinnaird *et al.* 2015). Therefore, the earliest phases of what may be deemed urban activity and accumulation begin in the sixth century BCE within Trench R. Artefactual evidence from this phase includes beads of agate and terracotta, as well as ceramic finds of Grey Ware (GW), Red Ware (RW), Black Slipped Ware (BSW) and a Northern Black Polished Ware (NBPW) rim.

3.3 Phase 3

Directly below Mitra's unexcavated baulk, and cutting the trampled natural below, we exposed a large rectangular cut, context [161] (Figure 4), with vertical sides, a flat base in the south and a rounded base a metre to the north, which reached a depth of almost one metre. It is postulated that this pit feature may have incorporated a large timber post. The fill of this pit and post feature, context (160) was filled with a firm silty olive brown material, which included charcoal and pottery including (RW) and Black Slipped Ware (BSW).

Most significantly, we also identified the presence of an early palisade slot, context [238], cutting through these earlier phases of occupation and agricultural activity. The palisade ran across the trench for six metres, on a broad north-east to south-west alignment within the northern portion of Mitra's baulk. It was substantial and measured 0.60 metres wide and 0.80 metres deep. The base of the palisade was filled with a thin, very dark brown silt context (272). Within the base of slot [238] were nine postholes following the same alignment of the palisade (Figures 4, 5 and 6). These postholes varied somewhat in shape and size but all measured between c. 0.15 and 0.20 metres in depth. The postholes were all filled with a soft, grey and yellow mottled fill and contemporary with each other. Their depths had been truncated by the cut of a later palisade slot above. Palisade slot [238] was filled by soft, silty, dark yellow brown silt context (259), above primary fill context (272). Context (259) contained inclusions of ceramics and some charcoal, as well as nodules of kanker. An OSL determination from this fill dated to 720 ± 110 BCE but it must be noted that the sediments associated with this fill encloses mixed age materials and the dose distributions obtained for this sample show some aliquots which tail to higher apparent ages (corresponding to geological residuals), and some which tail to younger ages contemporary with construction, though it is thought that the construction most likely relates to the sixth century BCE (Kinnaird *et al*. 2015).

As noted above, this first palisade slot was truncated by a second episode of palisade construction, context [281]. This followed the same alignment as slot [238] but was narrower, with a width of between 0.40 and 0.50 metres and a depth of 0.60 metres. This second palisade was filled with context (237), a reddish brown material with crushed fired clay inclusions. Within this second palisade fill, nine postholes with depths of between 0.30 and 0.40 metres were identified (Figure 7). All nine were circular or sub-circular in plan and filled with a soft silty grey material. The fill of this second palisade, context (237), was extremely compacted and was presumably deliberated rammed around the wooden posts of the palisade to provide support. Two postholes, contexts [246] and [254], were much shallower than the other seven posthole cuts. It is likely that these were cut into context (237) at a later stage, rather than (237) being packed around two original timber posts, perhaps representing a later attempt to repair the timber palisade. This second episode of palisade construction was dated to 560 ± 90 BCE (Kinnaird *et al*. 2015) and this date, taken with the earlier palisade construction date suggest these features were excavated and laid during one of the earliest periods of human occupation in the vicinity of Trench R. This might indicate that site demarcation was of paramount importance to the settlement's early communities. Furthermore, the evidence of riverine action and flooding in Phase 2 of the sequence may suggest that the construction of palisades was an early attempt to control flood waters and protect the early urban settlement at Tilaurakot from the Banaganga River, which flowed past the north and west of the site. However, occupation similar to that from Phase 2, with sandy silt occupation deposits, did overlay these two palisade slots. It might be the case that further episodes of flooding and related water action occurred after the construction of these wooden architectural features.

3.4 Phase 4

Overlying the two phases of palisade and the early occupation horizons was a second phase of urban build-up. The definition between these phases is provided by context (134 = 223). This thin context, darker in colour than the urban sediments above and below, is suggestive of vegetation cover and enhanced organic matter content. It is likely that (134 = 223) may indicate a hiatus in activity in this area, with the gap between the underlying sandy silt first phase occupation and the second phase silty clay dominated deposits, allowing for vegetation cover to develop. Above this hiatus, occupation deposits are dominated by silty clay loams and contain frequent inclusions of fired angular clay fragments and charcoal. The geoarchaeological analysis of the compacted nature of some of this fired clay material suggests that the surfaces were prepared, and the identification of fine banded silty loam accumulations indicates that there were water-based movements across these surfaces. However, the absence of mottling within this phase of the stratigraphy indicates that these urban accumulations were above the influence of the water table and the effects of flooding and standing water from the Banaganga River, unlike those in Phase 2.

The artefactual assemblage was dominated by RW and BSW ceramics. Ceramics, including several almost complete but broken vessels were uncovered on the surface of context (130 = 214), representing an occupation surface, which was associated with context (131), a compacted floor surface prepared using rammed angular fired clay fragments. Several features were identified cutting into the occupation levels of Phase 4, further emphasising the occupational nature of these deposits, including a large posthole, context (225)/

[224], cutting through context (222), (223) and the earlier Phase 2 occupation of (226), (227) and (230) below.

These earlier phases of urban occupation at the site were then truncated by an almost vertical cut, context [215]. It is hypothesized that this cut was part of activity associated with the construction of the clay rampart. Indeed, it may have served the purpose of both clearing and straightening the edge of site's earlier occupation deposits, which potentially had become eroded by river action in this part of the site, thus providing a clear working area for the construction of the clay rampart.

3.5 Phase 5

Rather than being represented by a single discrete material, the clay rampart was constructed from several deposits. Whilst some deposits, such as contexts (217) and (213) were mainly composed of clay, several deposits, such as contexts (211) and (216) were packed with small fired clay inclusions and it is suggested that these concentrated deposits may have been included to aid drainage and to act as a stabilising material during the construction phase of the clay rampart. These layers of deposits were then sealed by a smoothed and compacted silty clay, context (207). This contained a high frequency of ceramics and was potentially a capping deposit for the clay rampart, providing a smooth outer coating allowing for the run-off of water, a difficult surface to climb over and, finally, an aesthetic finish (Figure 8). Although built from several deposits, it is postulated that apart from the outer coating, the clay rampart was erected in a single, fairly rapid episode, with its construction dated to 450 ± 130 BCE, as measured from an OSL sample extracted from context (122 = 211), part of its core (Kinnaird *et al*. 2015).

The clay rampart contained a high concentration of artefacts, specifically ceramics, including CIW, BSW, and RW, as well as several complete vessels broken in situ. The rampart also contained two terracotta plaques of Sunga appearance with depictions of a man with a parrot. One of these plaques (SF788) was found in the smooth capping material of context (207), whilst the other (SF881) (Figure 9) was recovered from context (211) at the interface with context (207). Furthermore, the clay rampart was cut by a pit, context [121], which also cut through the earlier occupation deposits below. The pit was itself cut by Mitra's excavation trench to the north of the baulk and the identification of this feature showed a deviation from Mitra's interpretation of her east-facing section. The pit had a depth of 0.80 metres with steep vertical sides and a width of one metre east to west. Its fill, context (120), was a soft clay with some sand that was olive yellow in colour and contained inclusions of charcoal, brickbats and ceramics such as RW, as well as a moulded terracotta plaque (SF383), stylistically of a Sunga style, which depicted the goddess Lakshmi, who is associated with good fortune (Figure 10). Another terracotta Lakshmi plaque (SF240) was found at the interface of the pit and Mitra's cut, and there is a strong likelihood that this second plaque was also from the fill of pit cut [121].

The recovery of plaques from Tilaurakot's clay rampart, and from within pits cut into Early Historic ramparts more generally, is not a unique occurrence as similar Lakshmi plaques of a Sunga appearance were also found along the circuit of Tilaurakot's ramparts during the LDT's recent program of excavations (Himal Upreti pers. comm. 2013). Furthermore, a Sunga plaque was also identified during the excavations of the clay rampart at Saheth-Maheth in Uttur Pradesh, India (Aboshi *et al*. 1999: 142). This provisional information may suggest that terracotta plaques, particularly those depicting Lakshmi, may have been deposited within the clay ramparts of settlements during, as well as after, the construction of these monumental earthen walls. The plaques may have had a symbolic or ritual resonance, especially if the clay rampart was viewed as a liminal zone. Placed at the boundary which defined the urban core from its surrounding landscape, we may also recognise the potential symbolic value of a rampart which could represent the bounds of the universe itself within particular microcosms. Whilst it is hypothesised that the clay rampart was constructed in a relatively short phase of activity, the cut of pit [121] into the clay rampart suggests continued use and activity relating to the rampart after its initial creation. Certainly, the recovery of Sunga plaques from within the smooth clay capping of context (207) and at the interface with this material, also suggests that the clay rampart may have undergone phases of repair, some of which may have led to the accidental or votive placing of deposits within.

3.6 Phase 6

The brick wall, left unexcavated by Mitra, was exposed after the removal of a very thin topsoil. It also became clear that since the end of Mitra's investigations in this locality, the wall had been heavily eroded and degraded with the upper-most courses of brick suffering from erosion and bioturbation, which included ant nests and extensive root activity. The attrition to the brick fortification was further exemplified by a comparison of Mitra's photograph of the south-facing section in 1962 with those images taken after the removal of backfill in 2013. Indeed, we were only able to identify nine courses of brick (Figure 11) in comparison with Mitra's 16. The outer facing of the wall had almost completely eroded away, with brickwork surviving on the interior to a height of 0.80 metres on the west. From the surviving brickwork, it was clear that the wall comprised courses of single bricks set as regular outer-facings whilst its core was formed by irregular brick and brickbat coursing. The foundation of the brick fortification wall was rammed into the clay rampart below with an almost vertical, steep and rectangular cut for the laying of the southern brick outer-facing visible in the east-facing section.

Whilst the brick fortification cut into and was rammed into the top of the clay rampart, brick collapse overlaid its slope to the north (west facing section, Figure 3). This material contained large bricks as well as brickbats, and it is hypothesised that the majority of this deposit may relate to the collapse of upper courses of the brick fortification wall. The lack of such a deposit in the east-facing section, and its concentration to the east of the trench, is suggestive of the possibility that there was a large structure adjacent to or on the brick fortification to the east of Trench R, possibly a tower or gateway, although further investigation of this hypothesis is required.

3.7 Phase 7

The final phase of our sequence is clearly linked to Debala Mitra's interventions at the northern rampart. Once we had cleared the dense vegetation in the vicinity of Trench R, we were able to observe the obvious surface depression marking her 1962 trench (Figure 12). We also cleared a thin topsoil from the top of the brick fortification that had been left in situ by Mitra as a baulk. During this process, we identified evidence of her investigations, including an upright iron nail (SF150), presumably utilised during the planning of her trench. Either side of the baulk, the cuts of Mitra's trenches were also identified and cleared of backfill. Mitra's backfill contained a mixture of decontextualised material, including brick, ceramics and slag, the bulk probably artefacts from her excavations at the site. Near the base of the cut, to the north and south of the baulk, iron nails and modern bricks utilised as markers of the trench floor were recovered. To the south of the baulk, we recovered two bricks stamped 1974 (SF215 and SF227), suggested that backfilling occurred 12 years after Mitra's trench was initially opened.

4. Conclusion

The excavations across the northern rampart were the first time the brick wall and rampart at Tilaurakot had been cut fully through and provided the opportunity for us to explore the earlier phases of development at the site. These investigations have provided a clear developmental sequence for Tilaurakot's fortifications, including three defined phases of site definition, as well as the site's urban development. Whilst confirming some of Mitra's initial interpretations, such as the sequential construction of a clay rampart and then a brick wall above urban occupation deposits, our recent excavations have also identified the presence of an earlier period of site demarcation. The OSL dates indicate that the perimeter of the early settlement was defined by two phases of timber palisades in the sixth century BCE, refuting Mitra's assertion that there was no occupation in this area of the site prior to the third and second centuries BCE. Indeed, our new sequence has also identified a period of early cultivation at the site from around the sixth century BCE, which then transitioned into an urban settlement. Not only have these new investigations of the northern rampart provided a scientifically-dated sequence for these phases but we are also able to link this evidence to broader discussions of urban design in Early Historic South Asia.

It is generally agreed that urban forms began to re-establish themselves across South Asia during a phase of reintegration between 600 and 350 BCE (Coningham and Young 2015: 354). Representing increased communal investment and rising social and economic complexity, many of the fortifications of these South Asian urban forms have been excavated and investigated. The formation of fortified urban forms was prevalent in the Ganga Basin during the Early Historic period with many examples to reference. For example, the 200 hectare site of Kausambi was surrounded a 6.44 kilometre circuit of ramparts attributed to the fifth century BCE. This earliest phase was represented by the construction of a seven metre high clay rampart, which was later topped by mud blocks faced with brick (Erdosy 1987: 5, Erdosy 1988: 61, Sharma 1960). Similarly at Rajghat, the earliest phase of fortification was a large clay construction surviving to a height of five metres (Narain and Roy 1977). One of the most impressive example of Early Historic fortifications in South Asia is found at Mahasthangarh in Bangladesh, where the well-preserved ramparts stand eight metres tall adjacent to a 100 metre wide moat. Topped by a brick fortification wall, the ramparts enclose 130 hectares (Coningham and Young 2015: 384). Although no dating evidence is available for the ramparts at Mahasthangarh, excavations at the site suggest that the earliest occupation relates to the late fourth and third century BCE based on finds of NBPW in the early sequence (Alam and Salles 2001). In light of our evidence from Tilaurakot, it is also worth drawing attention to the ramparts at Ujjain, where fortifications thought to date to the middle of the first millennium BCE, were built of clay stabilised by an internal timber framework (Banerjee 1960). Further afield in Sri Lanka, the earliest rampart at the urban form of Anuradhapura was an earthen construction that included redeposited bedrock, presumably spoil from moat and excavation. This phase of construction was thought to be contemporary to the site's Structural Period I, dating to between 350 and 275 BCE (Coningham and Allchin 1995: 167). However, while placing the initial phase of rampart construction in South Asia firmly in the Early Historic period, with dates from the fifth and fourth century BCE onwards, most of these dates, like the previous investigations at Tilaurakot, were based on relative dating and assumptions rather than scientific analysis. The sequence from Tilaurakot is therefore one of the few scientifically dated sequences available relating to the formal delineation of Early Historic cities in South Asia.

Whilst the dating of the brick fortification wall at Tilaurakot is not yet complete, the date for the settlement's initial occupation and the sequent construction of the clay rampart relates well to the dating of rampart construction elsewhere in South Asia. It can therefore be argued that monumental investment in clay ramparts is attributable to the era of reintegration from 600 BCE onwards, when *Mahajanapadas* emerged from competing *janapadas*.

The evidence of a deposit of a terracotta plaque from a pit cut into Tilaurakot's clay rampart and the discovery of two terracotta plaques in the capping of the clay rampart are indicative of the continued use of these monumental features after construction, perhaps for both symbolic purposes and maintenance. This further strengthens the notion that ramparts were not purely utilitarian architecture but may also have performed symbolic functions for a settlement.

Prior to the construction of the clay rampart at Tilaurakot, our evidence suggests that urban boundaries were provided by timber architecture from the sixth century BCE. The presence of two phases of palisades at Tilaurakot should not be surprising as wooden fortifications were identified at Pataliputra in waterlogged deposits as early as the nineteenth century in the suburbs of Patna (Coningham and Young 2015: 419). However, our evidence represents the first scientifically-dated wooden phase of palisade construction in South Asia. It is also of note, that one of the early excavators of the wooden beam palisades at Pataliputra was L.A. Waddell, an individual linked to the search for sites in the Natal landscape of the Buddha in the late nineteenth and early twentieth centuries. Interestingly, Waddell noted that the wooden palisade at Pataliputra was similar in appearance to the depiction of wooden fortifications at ancient Kapilavastu in a Gandharan sculptural frieze that he had obtained in the Swat Valley, remarking that the sculpture was created when "the traditional appearance of the old wooden walls had doubtless not been forgotten" (Waddell 1903: 22).

The discovery of two early phases of palisade-building at Tilaurakot suggests that wooden architecture may have been present at a number of early emergent centres but that this evidence either may have been missed by early excavators or obliterated by later phases of earthen and brick architectural emblishments. It also potentially suggests that the demarcation between urban and non-urban space was a concern from the earliest phases of the establishment of settlements, although further investigation is required elsewhere around the circuit of ramparts at Tilaurakot. One of the main reasons for this is to ascertain whether the palisades at Tilaurakot were a localised response to flooding from the Banaganga River. Indeed, our geoarchaeological analysis has shown that there was significant water action in the early phases of settlement in the vicinity of Trench R. As a result, it may be possible that the palisades represent a functional response to episodes of flooding in this area as much as a symbolic concern for site definition. Therefore, it is of importance to attempt to identify whether such timber architecture was present elsewhere around the site providing definition around the entire urban form or whether the palisades had a protective function, specifically for the north and north-west of the site in relation to the threat from the River Banaganga.

Finally, irrespective of these debates, it should be noted that the timber palisades were clearly laid out on a cardinal alignment east to west. This initial alignment was then followed by the later embellishments of the clay rampart and brick fortification wall above. As stated above, this leads to the hypothesis that the full circuit of the city of Tilaurakot was first established in or around the sixth century BCE, strengthening the assumption that the city was pre-planned, exhibiting similarities in design advocated in Early Historic planning treatises. This also suggests that large-scale building projects, which involved the mobilisation of a large number of people and communal investment, occurred at an early stage of urban settlement. The evidence from the northern rampart of urban design and communal investment indicates that Tilaurakot was an established political centre with a degree of centralisation from at least the sixth century BCE onwards.

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7. Figures

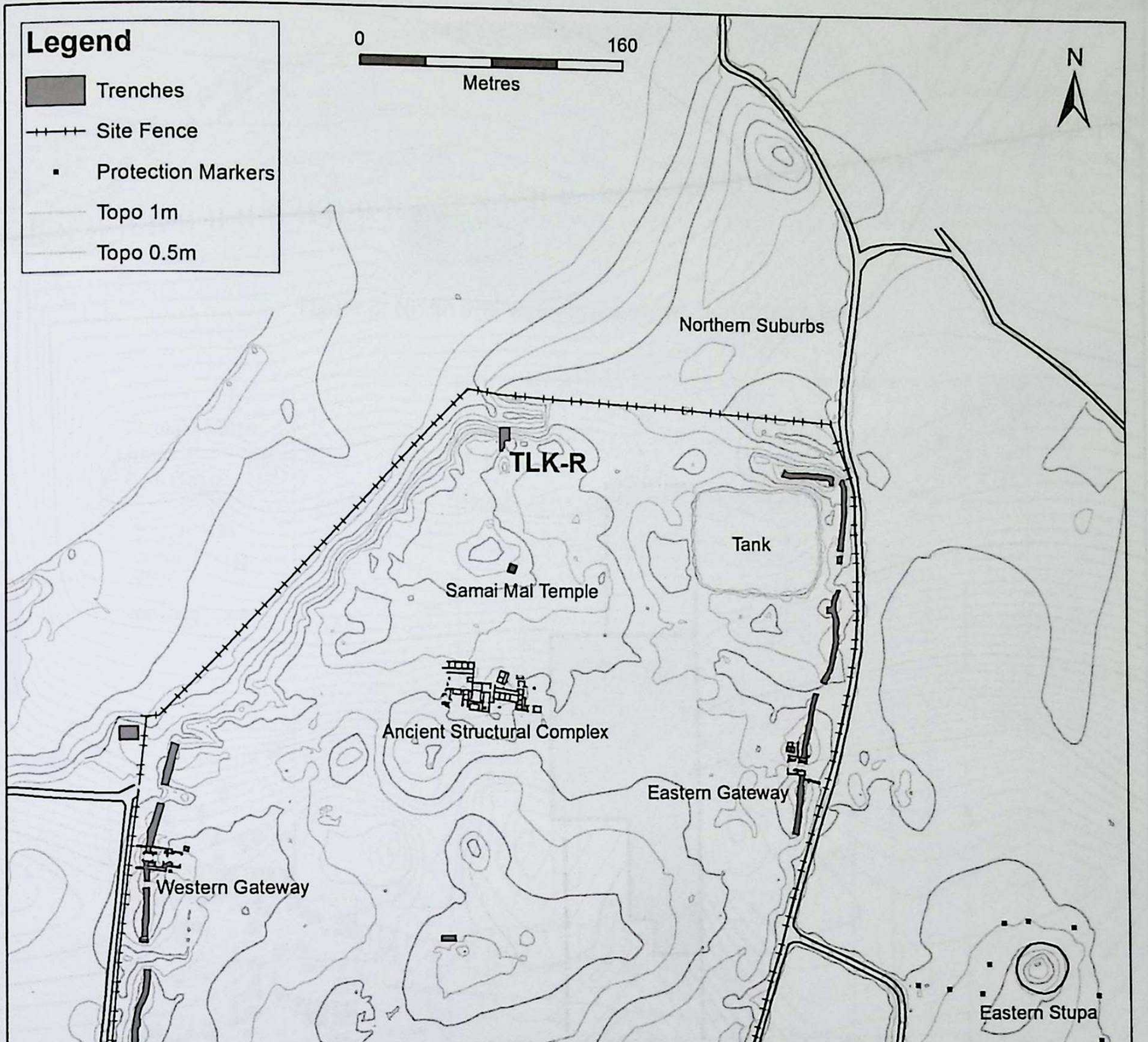

Legend
Trenches
Site Fence
Protection Markers
Topo 1m
Topo 0.5m
0
160
Metres
N
Northern Suburbs
TLK-R
Tank
Samai Mal Temple
Ancient Structural Complex
Eastern Gateway
Western Gateway
Eastern Stupa
Southern Industrial Mound

Figure 1: Location of Trench R, located within Debala Mitra's 1962 Trench TLK-1 across the northern rampart.

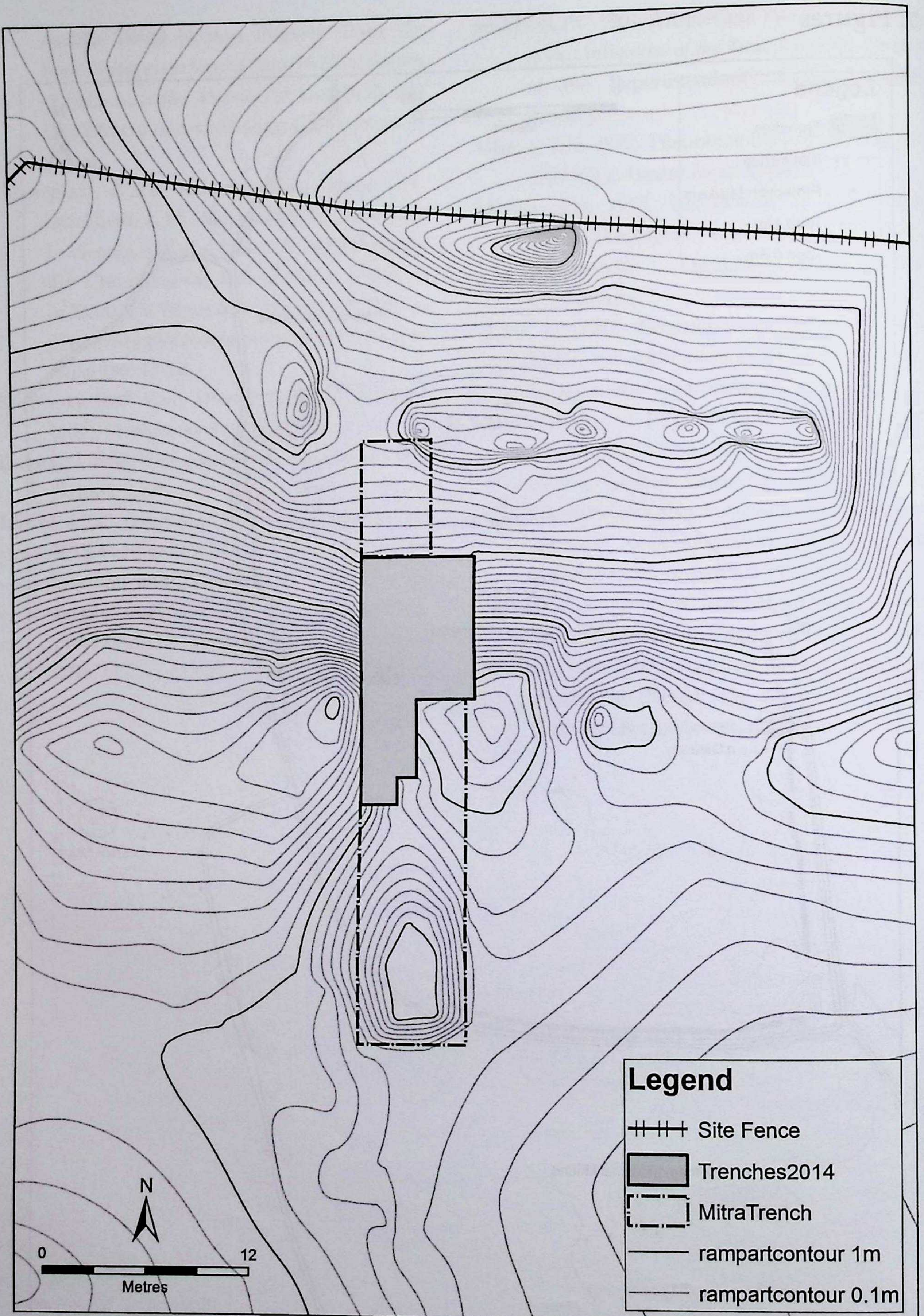

Legend
Site Fence
Trenches2014
MitraTrench
rampartcontour 1m
rampartcontour 0.1m
N
0
12
Metres

Figure 2: Detailed plan showing the extent of of Trench R and Mitra's Trench TLK-1 across the northern rampart

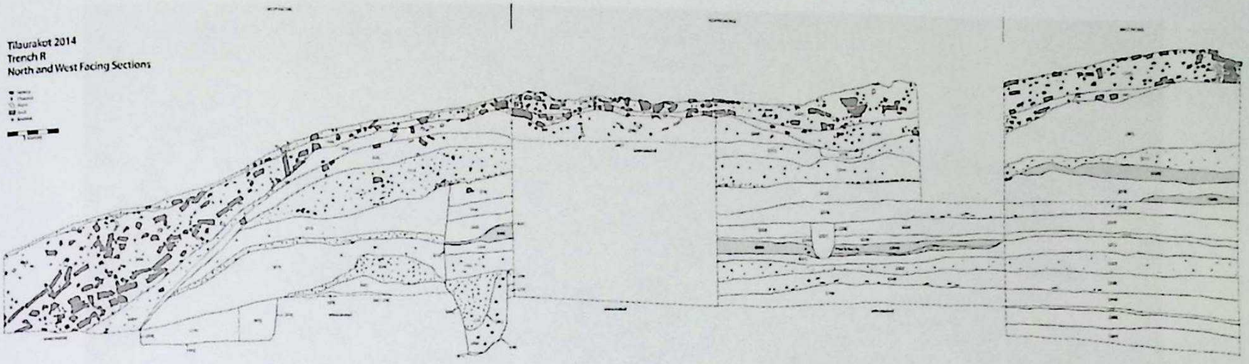
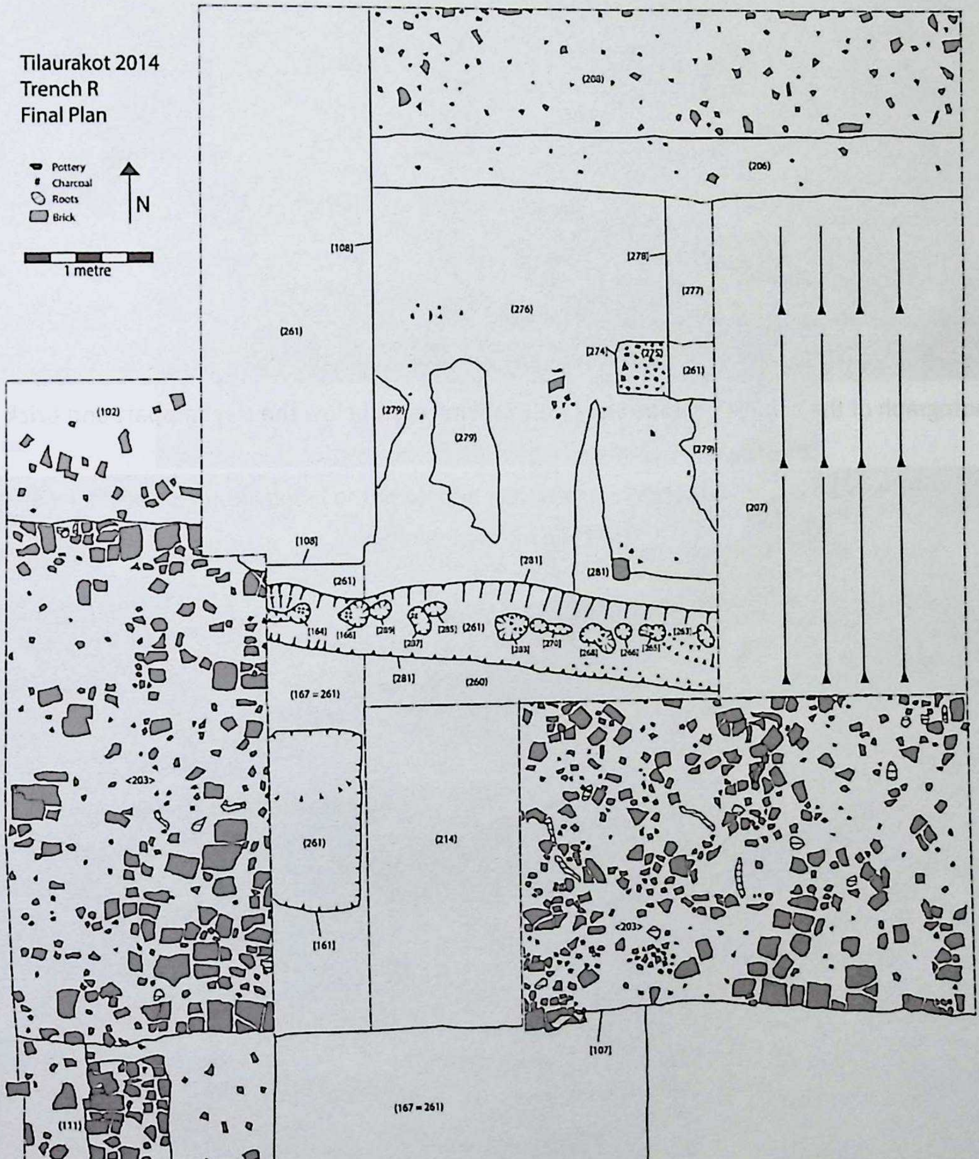

Tilaurakot 2014
Trench R
North and West Facing Sections

Figure 3: North and west-facing sections of Trench R.


Tilaurakot 2014
Trench R
Final Plan
Pottery
Charcoal
Roots
Brick
N
1 metre
(203)
(206)
[108]
(261)
[278]
(277)
(276)
[274]
(275)
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(279)
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(207)
[108]
[231]
(281)
(261)
[164]
[166]
[289]
[237]
[285]
(261)
[283]
[270]
[268]
[266]
[265]
[263]
[281]
(260)
(167 = 261)
<203>
(261)
(214)
[161]
<203>
[107]
(111)
(167 = 261)
[107]
[107]
<105>

Figure 4: Final plan of Trench R

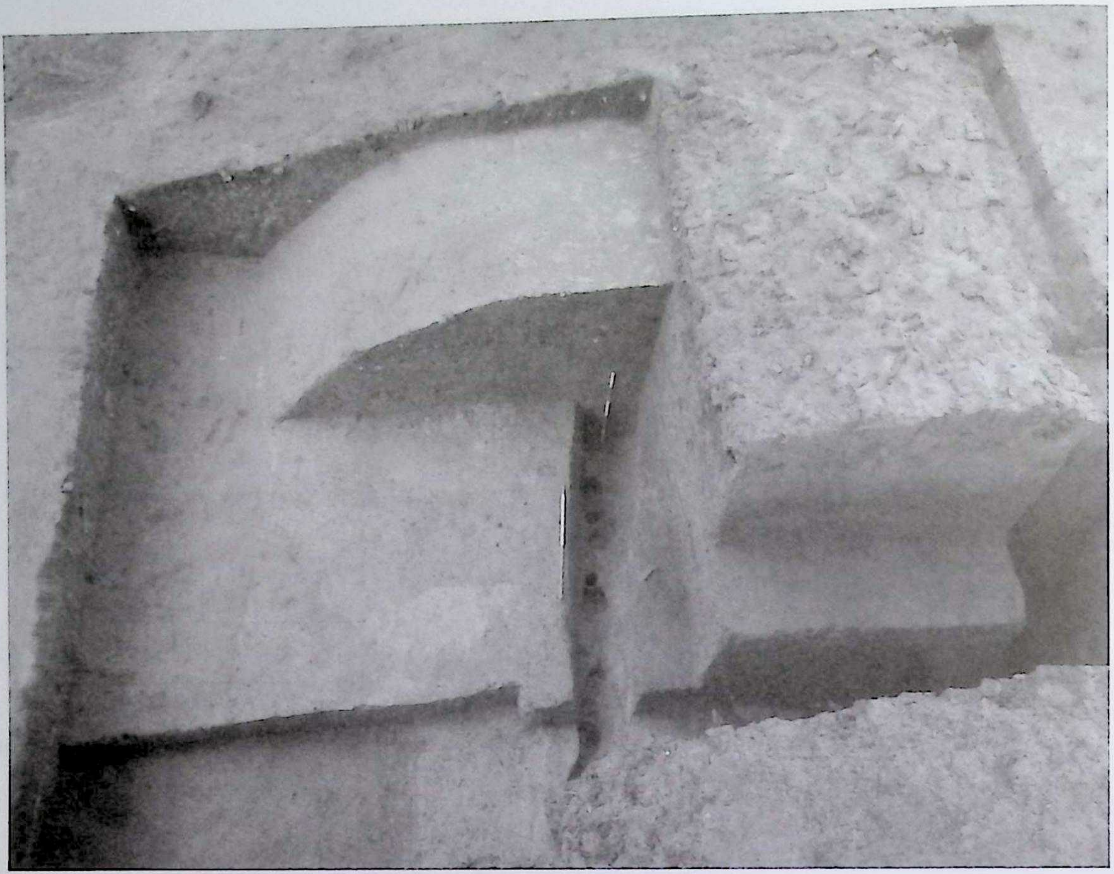

Figure 5: Photograph of the earliest palisade slot [238], looking east, below the clay rampart and brick fortification.

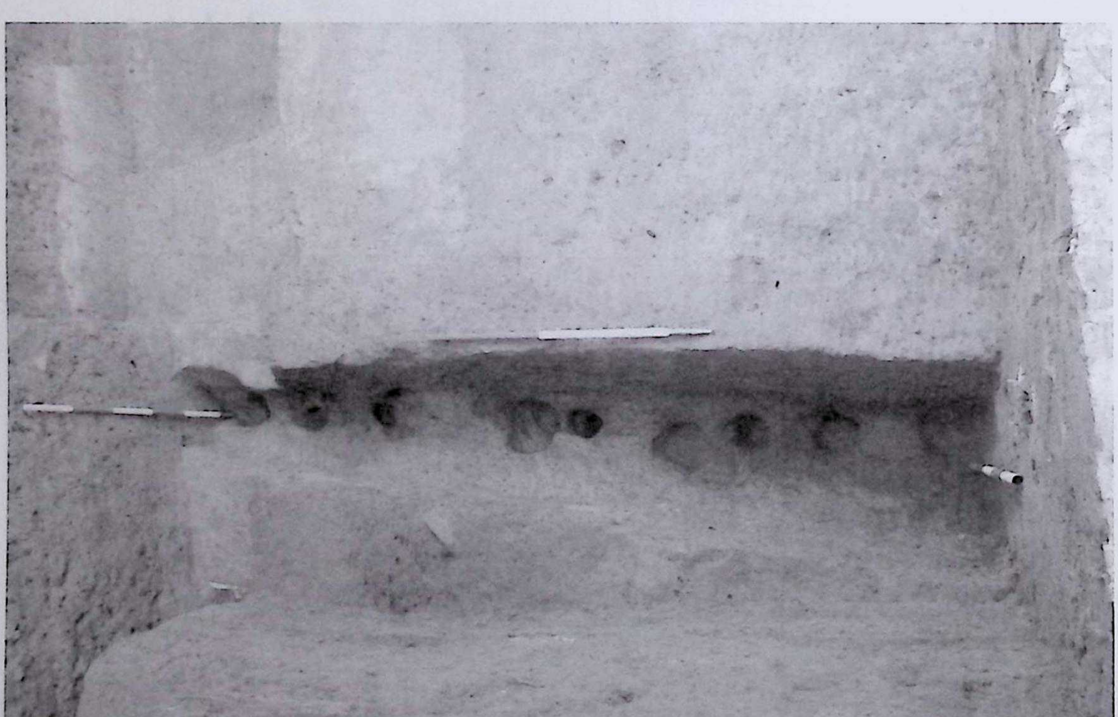

Figure 6: Photographic detail looking north of earliest palisade slot [238] and associated postholes.

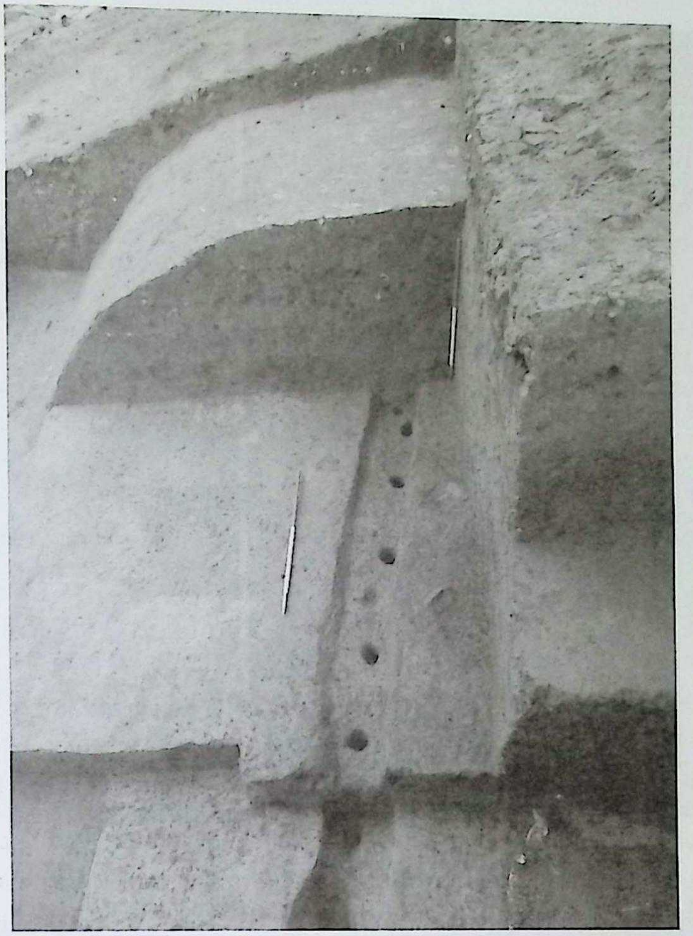

Figure 7: Photographic detail of the second palisade slot [281] and unexcavated posthole alignment within fill (237).

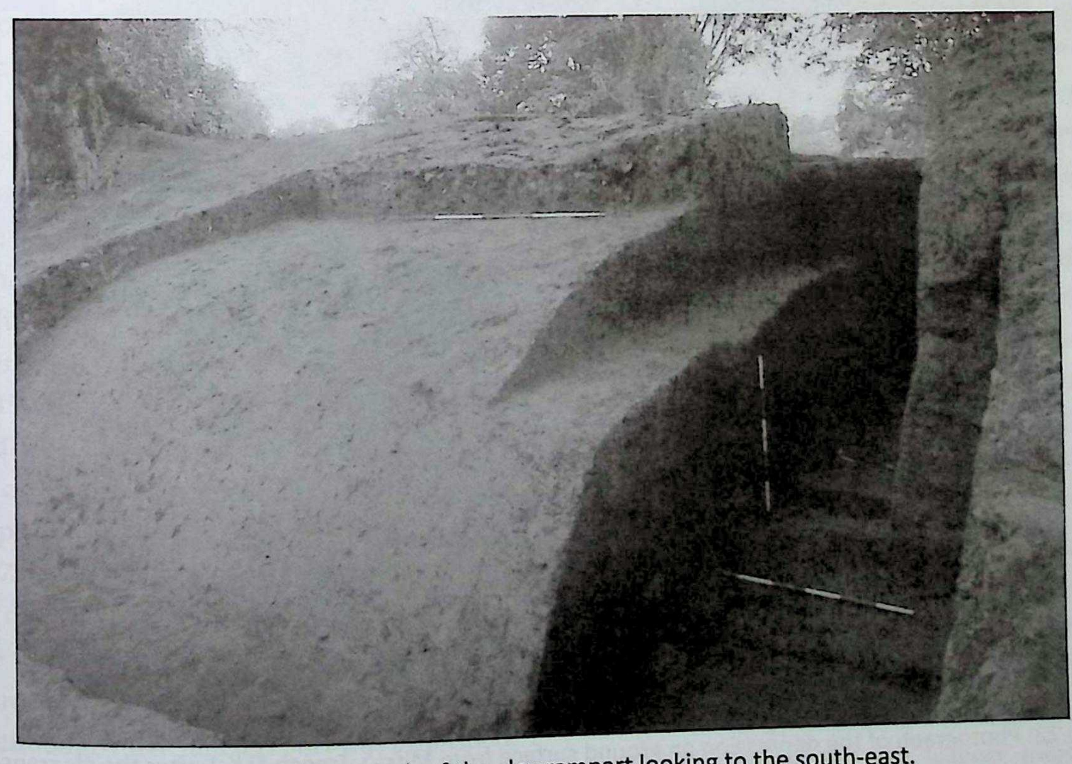

Figure 8: Photograph of the clay rampart looking to the south-east.

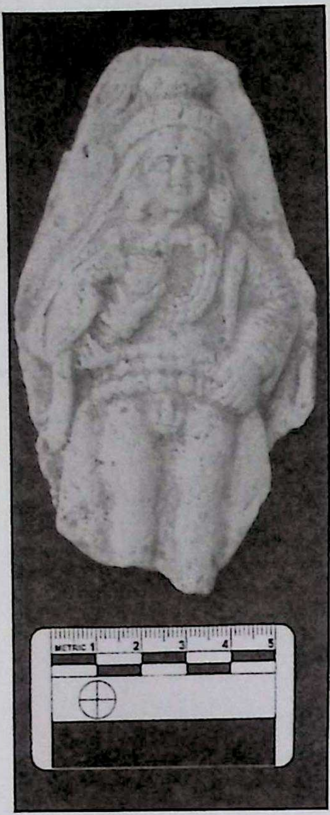

Figure 9: Photograph of Special Find 881, 'man and parrot' terracotta plaque from context (211)

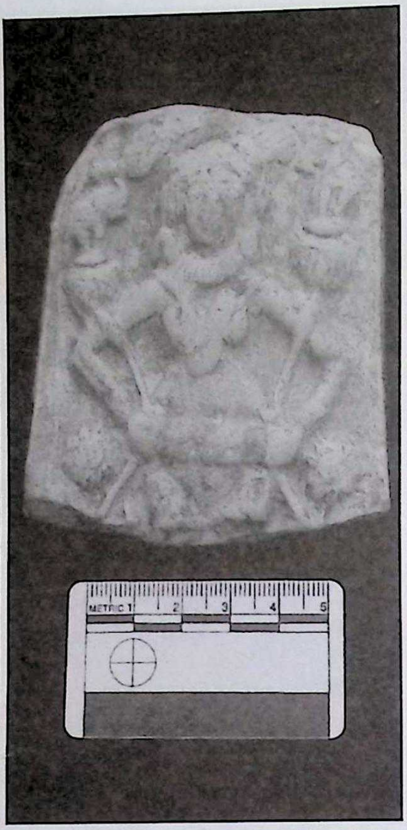

Figure 10: Photograph of Special Find 383, terracotta Lakshmi plaque from context (120).

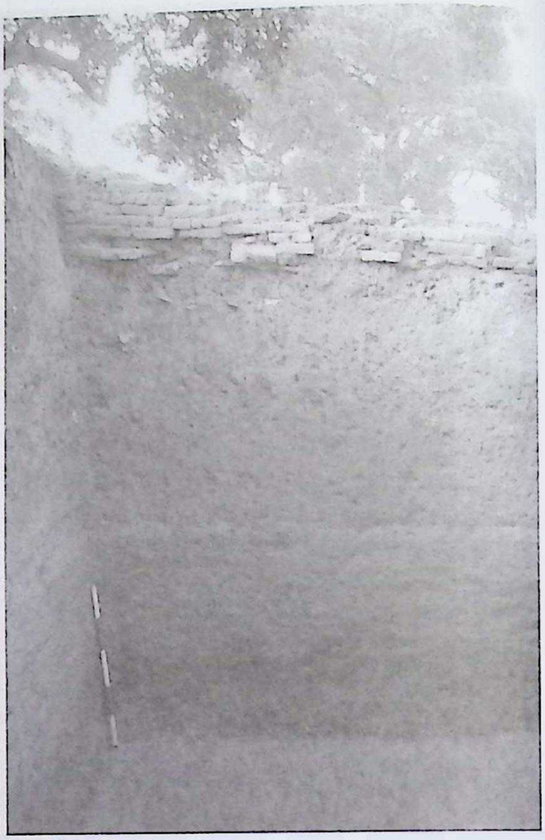

Figure 11: Photograph of the south-facing section of Mitra's baulk in Trench TLK-1 after removal of backfill in 2013.

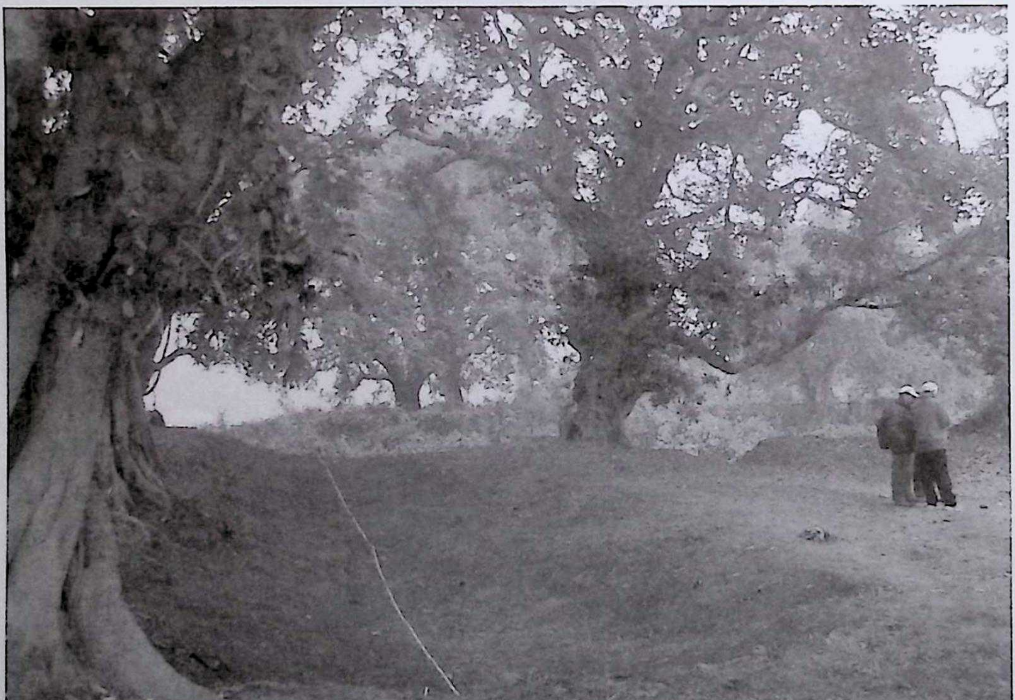

Figure 12: Photograph of the depression on ground surface from Mitra's Trench TLK-1 after the clearance of vegetation in 2013.

Recent excavations at Tilaurakot's southern Industrial mound: a preliminary report

- Strickland, K.M., Coningham, R.A.E., Acharya, K.P., Dahal, B.N., Davis, C.E., Kunwar, R.B., Tremblay, J., Simpson, I.A., Jones, J. and Hale, D., K.C., Krishna Bahadur and Bidari, Basanta

1. Introduction

Tilaurakot's southern industrial mound, known locally as Lohasariya, is a low mound located approximately 150 metres south of the ancient city. Measuring approximately 50 metres on its east to west axis and 30 metres on its north to south axis, metal-working residue is thickly scattered across its surface (Figure 1). The presence of this substantial area of metal-working beyond the city walls of Tilaurakot was first recorded by P.C. Mukherji during his survey in 1899. In a plan dating to the same year, Mukherj initially identified the mound as one of ancient Kapilavastu's cardinal stupas (Allen 2008: 191) but subsequently noted in his final report that "On the south of the southern ditch is a mound of earth, where is scattered a large amount of iron refuse, or something like it, which shows that there was a large workshop here in ancient days" (1901: 22). This early identification was not pursued by Debala Mitra of the Archaeological Survey of India, whose plans of the site did not extend past the moat on the southern edge of the city (1972). Characterised by an extremely high surface density of slag, a sondage was excavated into the mound in the 1970s by B.K. Rijal of the Department of Archaeology, Government of Nepal, although no detailed report was published. Consequently, one of the primary aims of the 2012 excavation was to characterize and scientifically date this industrial activity and thus to articulate it with the cultural sequence of the ancient city, while the 2014 geophysical survey to define its spatial distribution.

2. Geophysical survey of the southern industrial mound

In order to better define and characterise the subsurface archaeological deposit, which would in turn facilitate research and inform management and conservation issues, particularly with regard to any future development, we undertook a geophysical survey between the southern rampart and around the southern industrial mound. The northern part of this 2.7 hectares area comprised open grazing with the broad low mound of the southern industrial mound, and its associated debris to the south. The southern, western and eastern edges of the mound were defined by small fields, typically paddy, mustard and dhal. It was not possible to collect survey data in some parts of the area due to some thicker stands of scrub and near ripe dhal crops. The survey area measured an area of 140 metres north to south and 180 metres east to west (Figure 2) and measurements of vertical geomagnetic field gradient were determined using a Bartington Instruments Grad601-2 dual fluxgate gradiometer. The sample interval was

0.25 metres and the traverse interval was one metre, thus providing 3,600 sample measurements per 30 metre grid unit. Anomalies on the northern edge of the survey reflect a slight bank along the southern edge of the partially silted moat south of the metalled road. Immediately south of this bank is a very broad band of smooth, almost featureless data, some 55 metres wide. It is possible that this band reflects a second or earlier moat, filled with silt. Two positive magnetic anomalies within the possible moat area correspond to the location of a cricket square, and may reflect material that has been deposited to provide a level surface.

To the south of the possible moat is a large concentration of intense magnetic anomalies, which reflects the mound of metal-working debris. Several larger dipolar magnetic anomalies were detected along the northern side of the mound. The orientation of some of these anomalies is such that they could reflect structures which were fired in situ; such features which might survive include the floors of smelting furnaces. However, these anomalies could also reflect larger ferrous items. One possible furnace lies just north-east of an earlier excavation trench and others may lie to the north-west. Our geophysical survey has thus demonstrated the possibility of the presence of a second moat located beyond and to the south of Tilaurakot's known rampart and moat complex, whilst also suggesting further industrial activity around the southern industrial mound. The identification of potential furnaces correlates well to the identification of a possible furnace within Trench S and further demonstrates the industrial nature of activity in this area of Tilaurakot and also the distribution of archaeological remains beyond the walled urban core of the site.

3. Excavations at the southern industrial mound

A single cardinally-oriented trench, Trench S, was excavated on the mound in order to provide a chronometric sequence. Measuring four by three metres, it was sited immediately north-east of Rijal's old trench, which was approximately located in the centre of the low mound (Figure 3). The excavations utilised the context system and the phases of activity are described in reverse chronological order – from earliest to latest.

3.1 Phase 1

The first significant phase of cultural activity at the site appears to have involved the deliberate creation of a mound, thus raising of the area above the local level of inundation. The in situ natural, a mottled yellow and grey clay with kanker and manganese inclusions, was sealed at a depth of 2.15 metres below the surface by a clean fine grey sand context (29) containing both slag and Red Ware (RW) ceramic sherds. The interface between these would thus appear to represent an extant palaeosurface, while the fine sand appears to represent slow flowing water, likely relating to branches of the nearby Banganga River, thus demonstrating the need to raise the ground level above that of the surrounding flood plain. This grey sand was in turn overlain by a thin bar of olive brown sandy clay context (30), rich in slag, with occasional brickbat and charcoal flecking and several sherds of ceramics, including a single sherd of Cord Impressed Ware (CIW). This deposit was radiocarbon dated to between the early sixth and late fifth centuries BCE. More significantly, this grey sand and overlying bar were sealed by a thin crust of iron-panning, which is potentially indicative of seasonal standing water in an iron rich environment. However, the iron-panning is almost certainly a later formation, most likely formed by water draining through iron-rich deposits of slag above, before pooling upon the impermeable surface of the in situ natural clay.

3.2 Phase 2

This was then followed another episode of deliberate mound creation, raising the area above the level of the plain and likely above the level of localised flood waters, as represented by the pale grey sand in Phase 1. This deliberate mound creation appears to have occurred in two distinct episodes. Firstly, the deposition of an initial 0.4 metre thick platform of redeposited natural with frequent cultural inclusions such as charcoal, slag, fragments of furnace lining and ceramics including sherds of RW, Black Slipped Ware (BSW) and CIW. Secondly, this was subsequently sealed by a thick, ranging from 0.35 to 0.60 metres, and similar layer of re-deposited natural. Again, this deposit of sandy clay loam included cultural inclusions, such as sherds of CIW and charcoal, in addition to fragments of slag and furnace lining. A radiocarbon sample from this secondary episode of mound creation was dated to between 373 and 199 BCE (95.4% confidence), representing perhaps an intensification in industrial activity. Notably the presence of artefacts associated with iron smelting – such as slag and furnace lining – suggest the presence of iron extraction prior to the creation of mound. The upper surface of this artificial mound sloped sharply upwards towards the north-east corner of the trench, as seen in Figure 4 on the south-facing section. In the centre of the trench, however, an oval shaped mound was formed through the deposition of two cultural tips, both consisting of silty clay loam, oriented approximately east to west and sloping up the west of the trench. This mound, measuring some 0.70 metres thick, was rich in cultural material, including charcoal, CIW and several fragments of RW oil lamps. The formation of this oval-shaped mound appears to mark the end of artificial mound creation at the site, creating a mound above the level of the surrounding plain and, hypothetically, above surrounding flood waters.

3.3 Phase 3

This mound creation appears to have been followed very quickly, without hiatus or interim deposition, by the construction of what has been tentatively identified as the entrance or opening of a furnace, context <014>. A charcoal sample from this context produced a radiocarbon date of between 198 and 105 BCE (68.2% confidence), reinforcing the suggestion that this industrial activity closely followed closely mound creation. Unfortunately, it would appear that the bulk of the furnace lies immediately west of the trench section, only extending slightly from the east-facing section into the trench. The visible portion of this furnace takes the form of two symmetrical 'arms' of highly-heated pale blue clay (as seen in Figures 5 and 6). These 'arms', measuring approximately 0.65 metres in length and 0.25 metres in breadth, were positioned approximately 1.00 metre apart, with the opening wider to the east and narrowing towards the east-facing section. Following the construction of this potential furnace to the west, several episodes of slag dumping appears to have occurred around the base of the oval-mound, suggesting that fairly intensive in situ iron smelting was occurring during this time. As can be seen in the south-facing section (Figure 4), the dumping appears to have occurred from the west; the area identified as the likely location of the furnace, with material sloping down from east to west within the trench.

3.4 Phase 4

These dumps of slag were then overlain by an arcing tip (see south-facing section Figure 4) of furnace lining context (012=016) that again appears to have been deposited from the west, overlaying the slope of the slag heap formed by the previous episodes of dumping during Phase 3. However, although context (012=016) was rich in furnace lining, the positioning and orientation of these fragments argues strongly against in situ collapse and likely represents collapse or demolition off site and the subsequent dumping of the material on top of the existing slag heap. This tip of furnace lining was then followed by a levelling episode, with a relatively clean deposit of sandy silt raising the level of the surrounding deposits to that of the mound and the furnace arms <014>. These contexts were then sealed beneath a 0.35 metre thick collapse spread of furnace lining and brickbat with frequent slag inclusions within

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3.5 Phase 5

The final phase of activity at the site is marked by three extremely similar dumps of slag, initially sealing the furnace collapse and then sealing each subsequent of slag in turn. These contexts contained a quite extraordinary density of slag inclusions, in addition to moderate inclusions of charcoal, furnace lining and brickbat (Figure 7). Finally, in the north-west of the trench, bioturbation and site abandonment led to the deposition of a greyish brown silt topsoil, overlying the final slag dump. However, topsoil was absent from the majority of the trench with the final slag dump forming the surface deposit across the larger area of the area.

4. Metalworking Analysis

These excavations indicate that the southern mound functioned as a major extra-mural industrial locus from the fourth century BCE onwards, with the identification of later furnaces dating from second century BCE and clear evidence of in situ metal-working and the deposition of large quantities of slag. Indeed, the tips of furnace material suggest the periodic collapse or destruction of furnaces. A small amount of metal-working debris was sampled from the 2012 excavations at Trench S for further laboratory analysis at Durham University by Jennifer Jones. In total, 7.444 kilograms of industrial residues were examined from Trench S in order to characterise the residues and, where possible, identify the industrial processes from which they originated. The residues were examined visually or under X16 light microscopy, on freshly fractured surfaces with classifications based primarily on morphology, density, colour and vesicularity. Category criteria follow English Heritage Centre for Archaeology's Guidelines on *Archaeometallurgy* (Bayley *et al*. 2001). In addition, EDXRF (Energy Dispersive X-Ray Fluorescence) analysis, using an Oxford Analytical ED2000 facility and methods designed to detect a range of major, minor and trace elements, was carried out on five selected sub-samples, to assist with characterisation and identification.

4.1 Iron-working Residues

Almost all the material examined comes from iron-working and is residue from either smelting or smithing activity. Smelting is the first stage of the iron-working process, involving extraction of the metal from the ore in a furnace, where the ore is heated to separate the iron silicate slag from the iron bloom. Smelting slag is mainly an iron silicate, incorporating impurities from the iron ore, the furnace lining and from the fuel used. Smelting slag was usually periodically allowed to flow out of the furnace, tapped through a hole or tuyere in the furnace wall so that smelting could continue longer without a build-up of slag hindering the process. Smithing slag is the residue from working the iron bloom which results from smelting. This is a spongy mass of metallic iron still containing a high percentage of trapped slag and this slag must be hammered out of the bloom by smithing before objects can be forged from the metal. The iron bloom is kept at a high temperature during smithing to facilitate slag expulsion and the expelled slag consolidates into drips and pools around the smithing hearth. Accumulations of smithing slag would be periodically broken up and disposed.

It is not entirely clear from the visual examination, or EDXRF analysis, whether the Tilaurakot residues result from smelting or smithing activity. Much of the material is similar in appearance and lacks the usual (European) appearance of tap slag, whereby the upper surface is characteristically flowed and 'ropey'. The Tilaurakot interiors are dark and vesicular but possibly not quite dense enough for smelting residue. However, the extrapolated size and shape of the blocks of originally molten residue is more suggestive of smelting than smithing activity. All the fragments analysed have been broken up from larger blocks, many in antiquity, as evidenced by the formation of corrosion products on the broken edges. Traces of a curved edge survive on some pieces, suggests that the residues were originally circular. A very rough estimate of between 24 and 26 centimetres has been calculated for the diameter of the original blocks, using the curvature of the surviving edge fragments.

Many fragments have relatively smooth surfaces on one or both of the faces (Figure 8) and these are dark and/or red and heat-affected in colour and often show the fine creasing associated with skin formation on a rapidly-cooling liquid (Figure 9). The blocks are conjectured to have been roughly circular, flattish in the centre (between 1 and 4 centimetres thick) with thicker and rougher raised edges. The fairly smooth faces of the fragments suggest that the molten residues were expelled onto prepared surfaces rather than directly onto rough ground. Only two fragments, context (021) Y021 and context (012) SF42, have very small traces of clay attached, possibly originating from furnace or hearth. No fragments of burnt fuel were observed. Several pieces of residue have folded while in a plastic state, leaving an air pocket between the folds (Figure 10). This indicates that the residue was expelled rapidly and in sufficient quantity to cause it to pool and fold before it lost its plasticity on cooling. The production of such a relatively large volume of residue in one session suggests either that this is smelting residue or the existence of a large scale smithing operation.

Two samples, Context (002) SF7 and 023 <Y027>, were selected for EDXRF analysis and the sub-samples crushed and pelletised to ensure homogeneity. The analysis detected mainly iron (44% and 51%) and silica (35% and 34%), along with a range of earth elements such as magnesium, aluminium and calcium. Constituents of both smithing and smelting residues can be very variable, which is reflected in analysis results. This variability results from the source and quality of the ore used and from the efficiency of the iron working process. Figures obtained from the small number of analyses carried out for this assessment are not sufficient for a definitive identification of the material examined.

4.2 Other Residues

Only 0.053 kilograms of non-ferrous residue were identified. One sample, Context (003) <Y004>, comprised a number of tiny spheres of iron-rich material along with a single sphere of corroded copper alloy. Examination of the interior of one of the iron spheres found it to be lamellar and homogenous with no indication of vitrification or vesicularity as would be expected if it were associated with metal-working. It was concluded that the iron-rich spheres are of natural origin. The single copper alloy sphere was not broken open but EDXRF analysis of its surface detected some copper and tin, with traces of zinc and lead. It is probable that this represents an accidentally melted fragment of copper alloy. Evidence of corroded copper alloy was observed in three other samples from contexts (015) <Y028>, (022) <Y023> and (030) <Y26>. The matrix of all three is very dark in colour, very light weight and vesicular, and has the appearance of fuel ash slag (FAS). FAS is formed when the non-organic components of fuels react with silicates present in earth, stone or ceramic. It can form at temperatures achievable in a domestic fire or conflagration but its presence is not necessarily indicative of industrial activity. The samples from context (022) <Y023> and context (030) <Y26> have visible traces of green corroded copper alloy on the surface and very small red and green copper-rich areas were observed inside <Y023> when it was broken open (Figure 11). A sample was crushed, pelletised and analysed using EDXRF. A very small quantity of copper (<1%) was detected but the analysis was dominated by silica, iron and other earth elements characteristic of FAS. The weight and density of these samples is much too low to be residue from copper alloy-working and, again, it is likely that the copper alloy was accidentally melted in a fire.

4.3 Summary

The vast majority of residues undoubtedly derive from iron-working processes. However, this assessment could not determine whether this process was large scale smithing or smelting. Whilst the original size and shape of the residues, together with the evidence of rapid cooling of relatively large volumes of molten material, suggests smelting, the relatively low density of the material and (possibly) the EDXRF analyses are perhaps indicative of smithing.

5. Discussion and Conclusion

The results of the geophysical survey, excavation and laboratory analysis suggest that the mound to south of the walled city of Tilaurakot was a major zone of production. Athough it is not yet fully certain that the metal-working at Lohasariya relates to smelting, there is no doubt that manufacturing of metalwork, specifically iron, was undertaken here on an industrial scale. Our excavations have demonstrated that cultural activity in the area of the industrial mound potentially began in the beginning of the sixth or fifth century BCE. Evidence of metal-working is apparent in the artefactual record relating to the creation of an artificial mound, continued through the use of redeposited natural, between 373 and 199 BCE with further industrial activity, represented by a furnace, following shortly after at a date of between 198 and 105 BCE.

One of the major objectives of the excavations at Trench S was to better understand the articulation between this important industrial site and the Early Historic city itself. Whilst evidence of metal-working, as indicated by residues and crucible fragments, has been found throughout the core walled urban form, the density of slag within is nowhere comparable with that of the southern industrial mound (Coningham *et al*. 2016). Indeed, Trench S yielded almost 8 tonnes of slag, the vast majority relating to the potential decommissioning of the area in Phase 5. As it is likely that slag would not be transported far from the location of its initial production and neither would debris from furnaces, we may confirm that the southern mound hosted a major industrial complex from the fourth century BCE onwards. Furthermore, the geophysical survey also suggests the potential for other furnaces located around the southern industrial mound, strengthening this assertion for a concentration of industrial activity, although some caution is required as these geophysical anomalies have yet to be characterised or dated through archaeological excavation.

Compared to small scale smithing and metal-working within the confines of the fortifications of the city, such a vast industrial scale of manufacture and production would be extremely polluting and we would suggest that this major industrial activity was purposely located outside the city. Indeed, the location of a major industrial complex beyond the city's walls and moats suggests that there was active civic planning in terms of the zoning of core activities (Coningham and Young 2015: 218). Whilst small scale craft-working was practiced inside the city, large scale works were located outside the boundaries of the main urban core, away from the major concentration of habitation. Future research should address how this industrial activity was linked to the surrounding hinterland, as well as international and regional trade and exchange networks, especially with the evidence for goods and materials from elsewhere in South Asia currently being discovered and processed in current excavations across the site.

Our research at Trench S, and on the southern industrial mound more generally, has also highlighted the dangers to the preservation of Tilaurakot's subsurface industrial heritage.

Our identification of a possible second moat, running parallel to the southern rampart and the presence of potential furnaces associated with the southern industrial mound, informed a recent Heritage Impact Assessment at Tilaurakot which considered the building of a Bus Park on the site (Coningham *et al*. 2014: 84). Subsequently, these plans were rejected due to the negative impact on subsurface archaeological material identified by our research (Weise 2014). This demonstrates the very pressing need to conduct archaeological assessments prior to any proposed developmental activity within heritage sites in Nepal as well as the importance of linking archaeological sites with their broader and immediate hinterlands.

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7. Figures

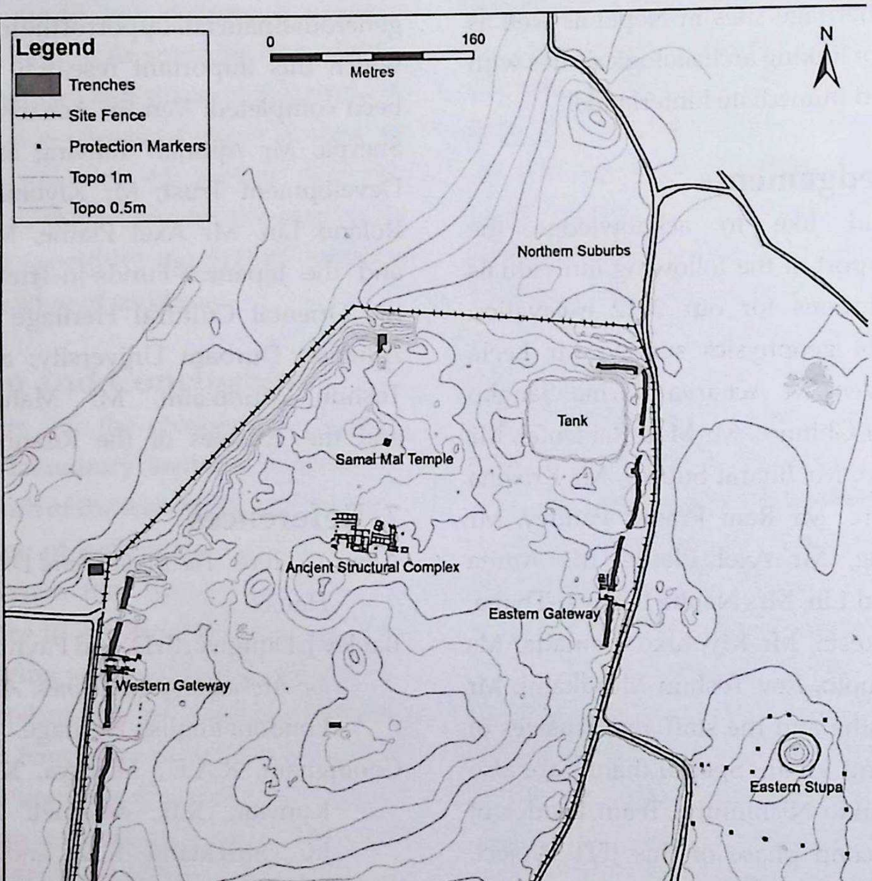
Legend
Trenches
Site Fence
Protection Markers
Topo 1m
Topo 0.5m
0
160
Metres
N
Northern Suburbs
Tank
Samai Mai Temple
Ancient Structural Complex
Eastern Gateway
Western Gateway
Eastern Stupa
Southern Industrial Mound
TLK-S

Figure 1: Location of Trench S on the southern industrial mound to the south of the fortified core of the city of Tilaurakot.

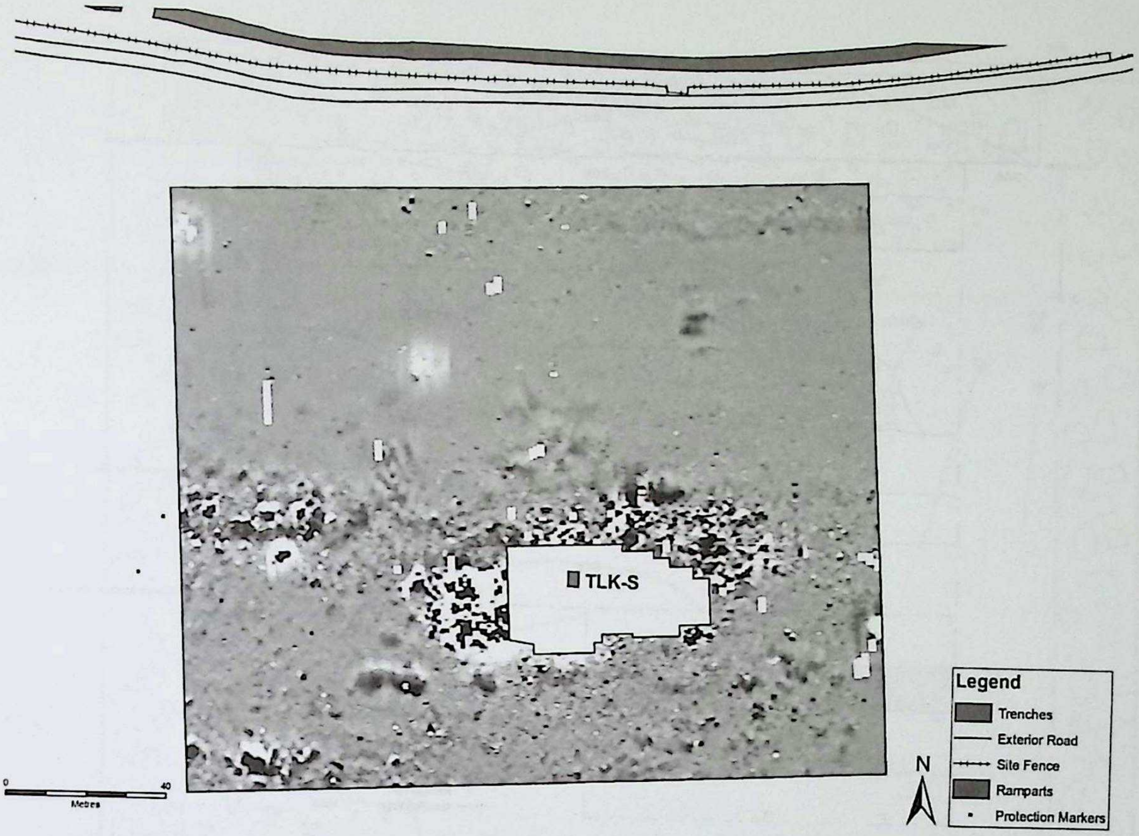
TLK-S
Legend
Trenches
Exterior Road
Site Fence
Ramparts
Protection Markers
N
0
40
Metres

Figure 2: Geophysical survey results around the southern industrial mound.

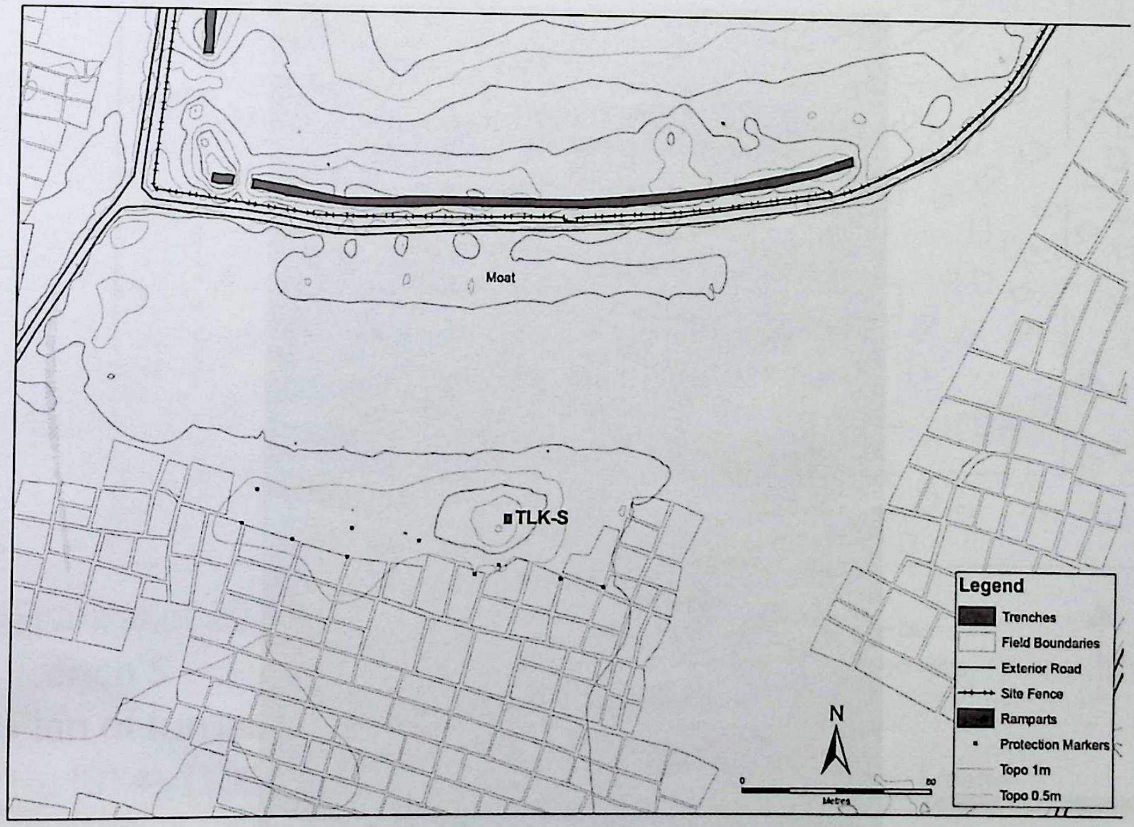
Moat
TLK-S
Legend
Trenches
Field Boundaries
Exterior Road
Site Fence
Ramparts
Protection Markers
Topo 1m
Topo 0.5m
N
0
80
Metres

Figure 3: Detail of the location of trench S in relation to surrounding modern field systems and the southern moat and rampart of Tilaurakot.

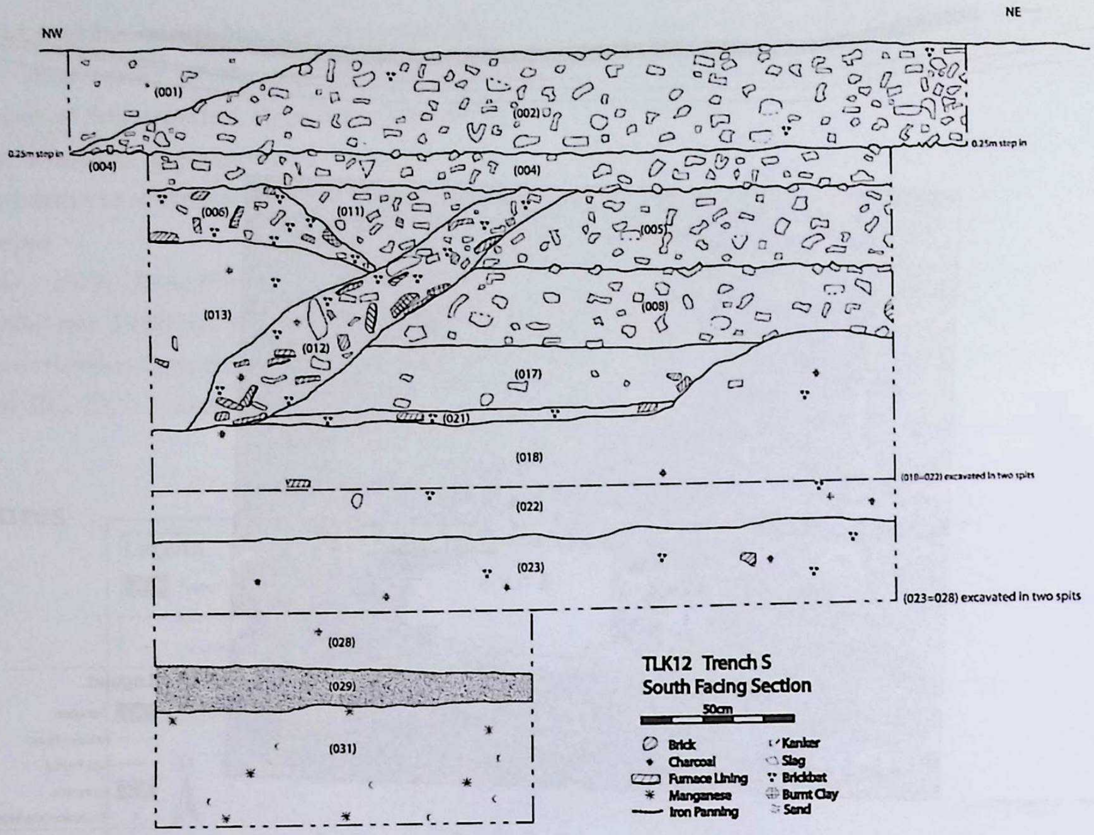
NW
NE
0.25m step in
0.25m step in
(001)
(002)
(004)
(004)
(006)
(011)
(005)
(013)
(008)
(012)
(017)
(021)
(018)
(018–022) excavated in two spits
(022)
(023)
(023=028) excavated in two spits
(028)
(029)
(031)
TLK12 Trench S
South Facing Section
50cm
Brick
Charcoal
Furnace Lining
Manganese
Iron Panning
Kanker
Slag
Brickbat
Burnt Clay
Sand

Figure 4: Trench S, South facing section

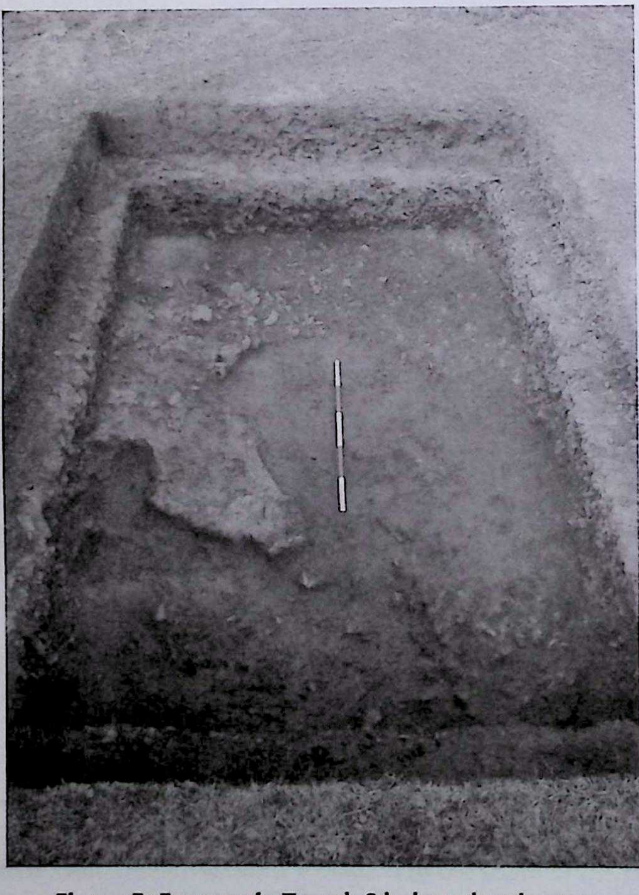

Figure 5: Furnace in Trench S below slag dumps.

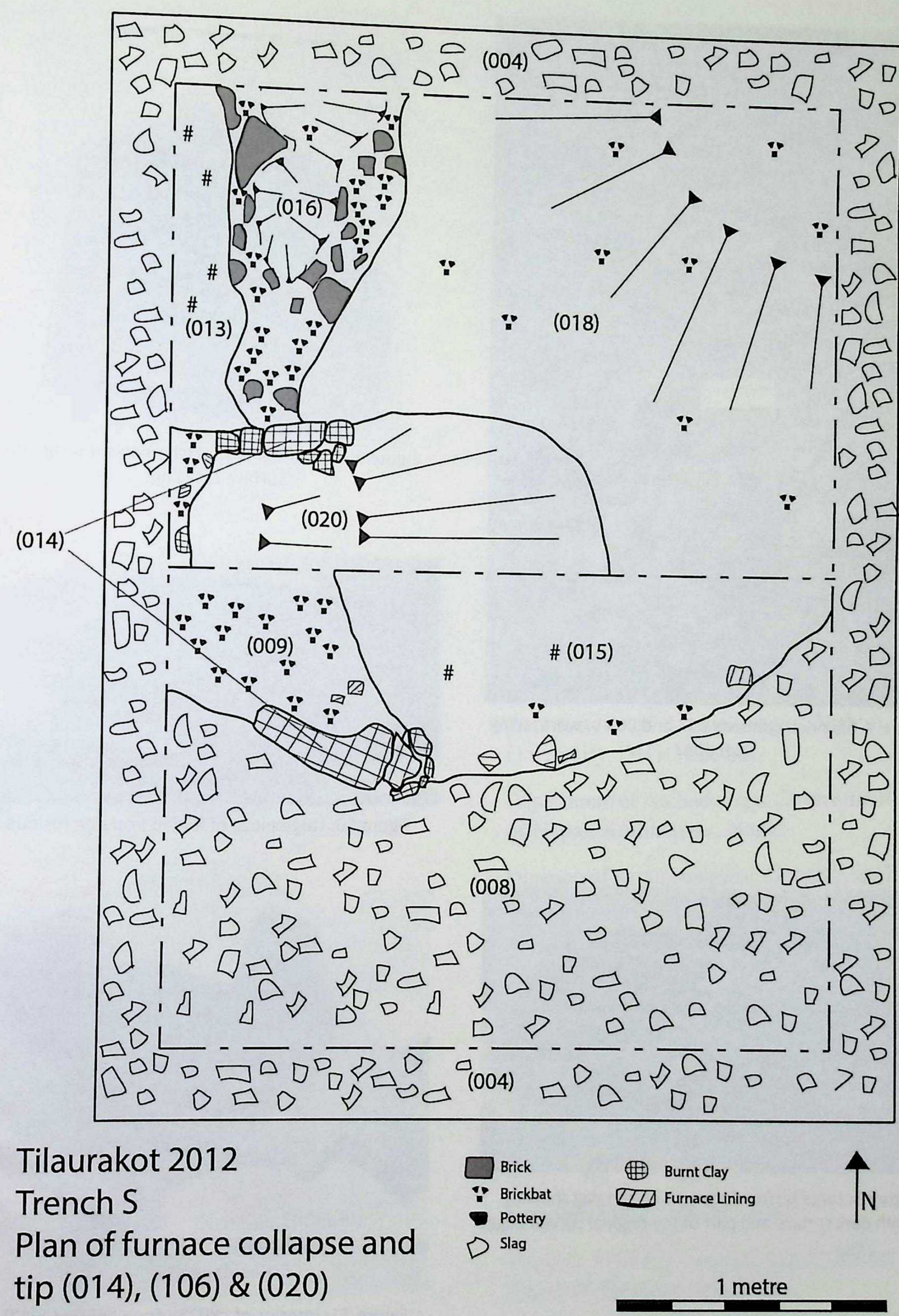
(004)
(016)
#
(013)
(018)
(014)
(020)
(009)
# (015)
(008)
(004)
Tilaurakot 2012
Trench S
Plan of furnace collapse and tip (014), (106) & (020)
Brick
Brickbat
Pottery
Slag
Burnt Clay
Furnace Lining
N
1 metre

Figure 6: Plan illustrating half section of furnace collapse and tip.

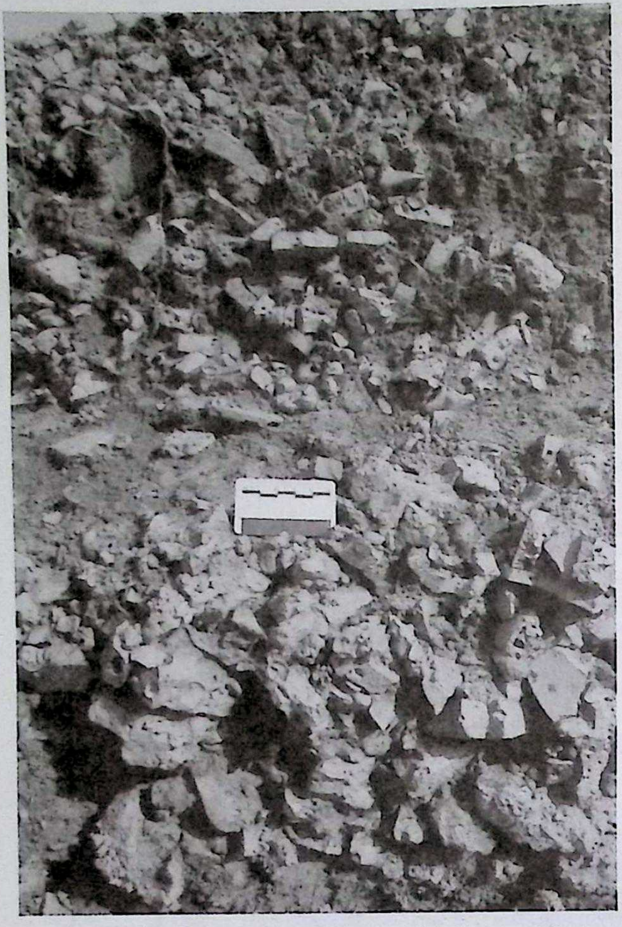

Figure 7: Slag rich contexts 004 and 005 in west facing section.

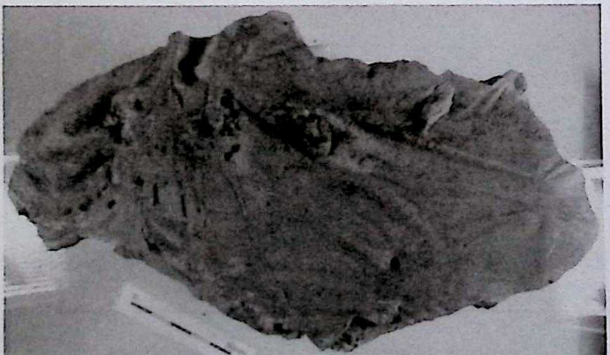

Figure 8: Large broken fragment of iron slag showing smooth dark surface and part of the original curved edge.

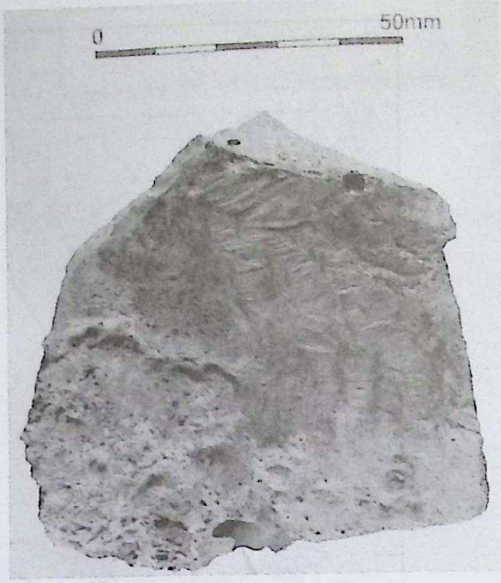

Figure 9: Small fragment of iron slag showing fine surface creasing.

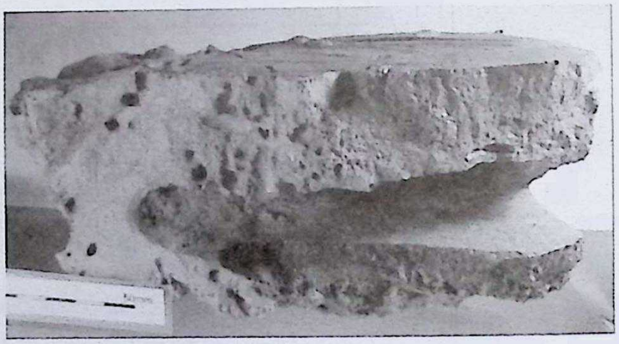

Figure 10: Large piece of folded iron slag residue

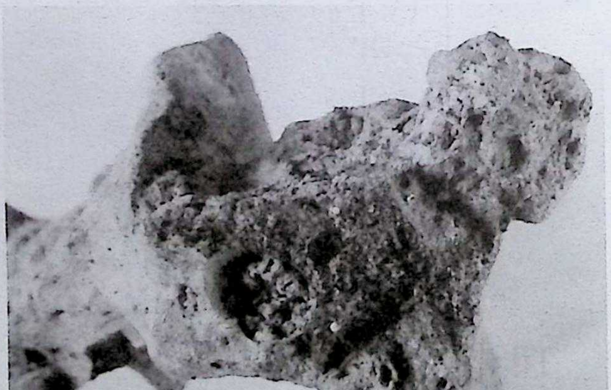

Figure 11: Interior of <Y023> from context (022), showing minute spots of red and green copper alloy in the dark, vesicular FAS matrix.

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का.मे.अ.द.नं. ८/६८, हु.द.स.बा.अ.नं. २/०२३

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रचना संक्षिप्त तर प्रामाणिक हुनुका साथै अद्यापि अप्रकाशित हुनुपर्दछ । तर कुनै प्रकाशित विषयको सम्बन्धमा नयाँ सिद्धान्त र प्रमाण प्रस्तुत गरिएको भए तिनको स्वागत गरिनेछ ।

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रामशाहपथ
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